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PANASONIC CT-20SX11E SERVICE MANUAL

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Service Manual

Color Television

Main Manual

(NA6DV)

Panasonic

Models	Chassis
CT-20SX11E	**AP380**
CT-20SX11CE	**AP380**

This Service manual is issued as a service guide for the models of the **NA6DV** family listed above. Included in this manual are a set of schematics, block diagrams, functional descriptions, alignment procedures, disassembly procedures, and a complete parts list.

"**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this Main Manual.

Panasonic®

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Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety Precautions

General Guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always Replace Protective Devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc.

High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **Handling the Picture Tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits the X-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **40kV** without causing X-ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage Current Hot Check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 1/2 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

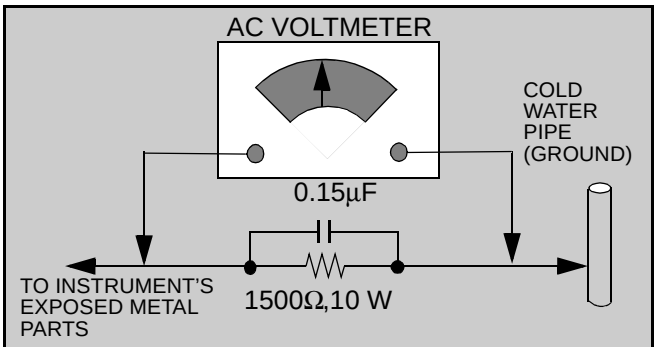

Figure 1. **Hot Check Circuit**

X-ray Radiation

WARNING: The potential source of X-ray radiation in the TV set is in the High Voltage section and the picture tube.

Note: *It is important to use an accurate, calibrated high voltage meter.*

Set the **brightness, picture, sharpness** and **color** controls to Minimum. Measure the High Voltage. The high voltage should be **27.7kV ± 1.25kV**. If the upper limit is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

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Service Notes

Note: These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.

Leadless Chip Component (surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

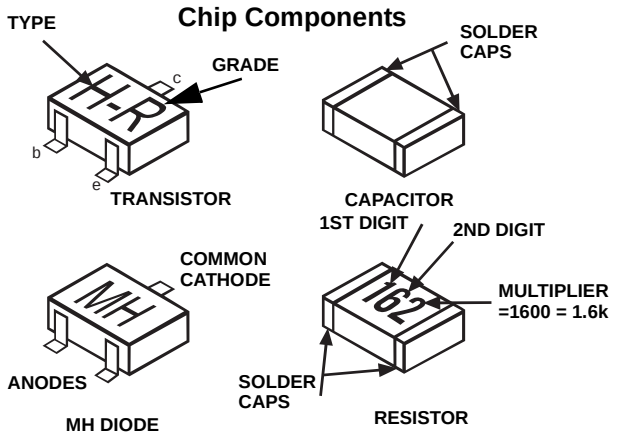
Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

Component Removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip Component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

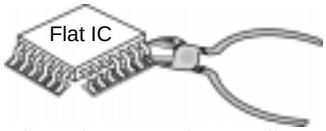


How to Replace Flat-IC

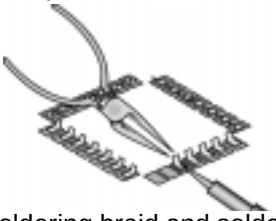
- Required Tools -

- Soldering iron
- Needle nose pliers
- Wire cutters (sharp & small)
- De-solder braids
- Magnifier

1. Cut the pins of a defective IC with wire cutters. Remove IC from board. If IC is glued to the board, heat the IC and release the IC. See Note above.



2. Using soldering iron and needle nose pliers remove the IC pins from the board.

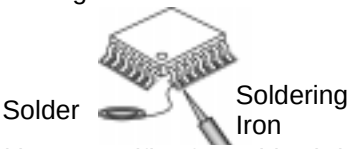


3. Using de-soldering braid and soldering iron remove solder from affected are on board (pads).

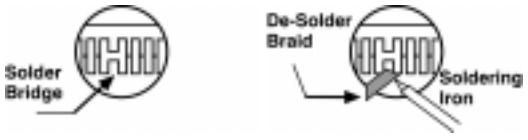
4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Determine the positions of the soldering pads and pins by correctly aligning the polarity symbol. Solder pin #1 first, align the IC.

Solder the pin opposite to pin #1. This will assist positioning the IC.

5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.



Service Notes (Continued)

IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CTR DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (⏚) or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X-ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.

Receiver Feature Table

FEATURE\MODEL	CT-20SX11E & CT-20SX11CE
Chassis	AP380
Tuning system	40K
# of channels	181
Menu language	Eng/Span/Fr
Closed Caption	X
V-Chip	X
75 Ω input	X
Remote Model #	EUR511502
Picture tube	A51LSK955X-A
PureFlat Picture Tube	X
Comb Filter	3 Line Digital
H. Edge Correction	X
V/A norm	Both
MTS/SAP/DBX	X
Bass/Treble/Balance	X
Surround Sound	X
AI Sound	X
FAO & VAO	X
Built-in audio power	5Wx2 (10%)
# of speakers	2
A/V in (rear/front)	2(2/1)
S-VHS Input (rear/front)	1/0
Headphone Jack	X
Dimensions mm (WxDxH) in	550x479x491.5 21.7 x 18.9 x 19.4
Weight (kg/lbs)	24.5/54.13
Power source (V/Hz)	120/60
Anode voltage	27.7kV ± 1.25kV
Video input jack	$1V_{p-p}$ 75Ω, phono jack
Audio input jack	500mV RMS 47kΩ
A-Board TNP2AH019	KA
C-Board TNP2AA047	AY
Z-Board TNP2AA010	AJ

Table 1. **Receiver Features**

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

Location of Controls (Receiver)

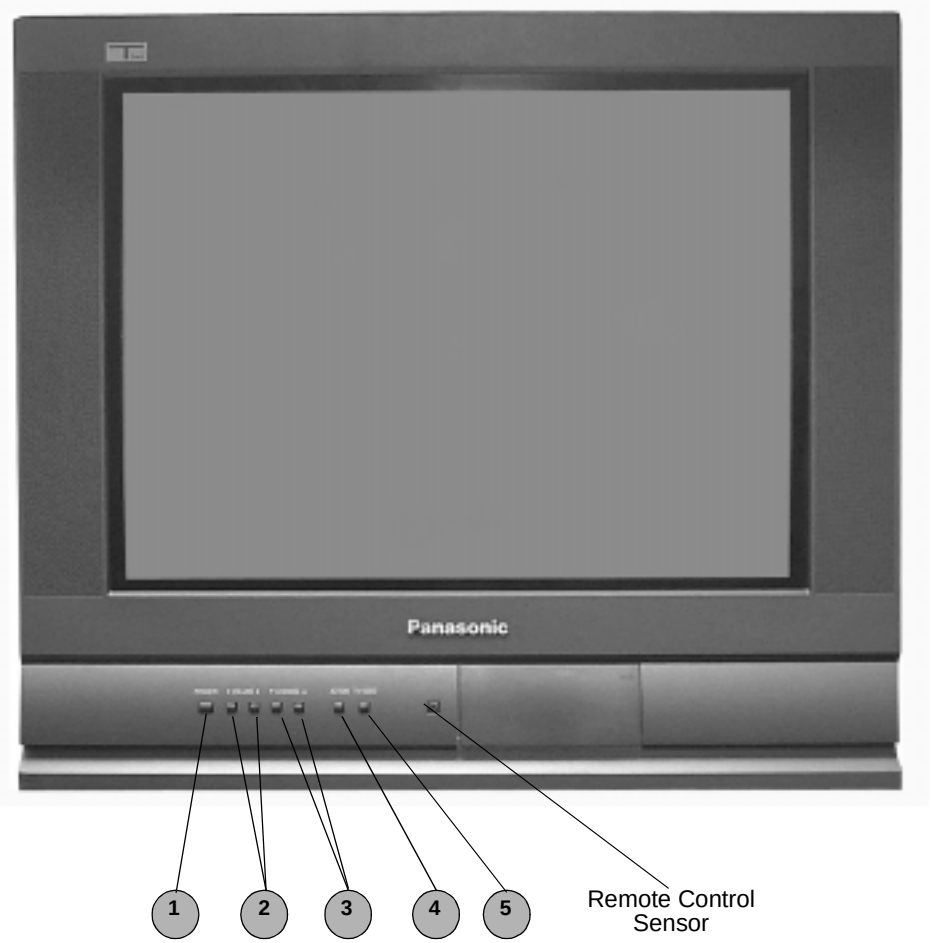


Figure 2. **Location of Controls (Receiver).**

Quick Reference Control Operation

Quick Reference Control Operation	
1	**Power Button -** Press to turn ON or OFF.
2	**Volume Buttons -** Press to adjust Sound Level, or to adjust Audio Menus, Video Menus, and select operating features when menus are displayed
3	**Channel Buttons -** Press to select programmed channels. Press to highlight desired features when menus are displayed. Also use to select Cable Converter box channels after programming Remote Control Infra-red codes (the TV/AUX/CABLE switch must be set in CABLE position).
4	**Action Button -** Press to display Main Menu and access On Screen feature and Adjustment Menus.
5	**TV/Video Button -** Press to select TV or Video Input.

Location of Controls (Remote)

Power Button
Press to turn ON and OFF.
ACTION Button
Press to display Main Menu and access or exit On Screen features and Adjustment Menus.
TV, VCR, DBS/CBL, DVD
Component function buttons.
VOL (volume) Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.
Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption display.
R-TUNE (Rapid Tune) Button
Press to switch to the previous channel.
REW, PLAY, FF, TV/VCR, STOP, PAUSE, REC, VCR/DBS CH
Component function buttons.

EUR511502

LIGHT Button
Press to light remote control buttons.
TV/VIDEO Button
Press to select TV or Video input.
CH (channel) Buttons
Press to select channels. Use with volume buttons to navigate in menus.
DBS EXIT, DBS GUIDE
DBS function buttons.
RECALL Button
Press to display Time, status of Sleep Timer, Channel, Video mode and Channel Caption (Station Identifier).
“0” - “9”
Press numeric keypad to select any channel.

Figure 3. **Location of Controls (Remote).**

Disassembly for Service

Back Cover

Remove all the screws marked with an arrow(◄) from the back of the Receiver.

Note: *Screw configuration, type, and number of screws vary depending on the model of the Receiver serviced and the application; various models are covered in this Manual. Use same hardware when reassembling the receiver.*

- 2 screws at the top edge of the Receiver.
- 1 screw at each lower corner of the Receiver.
- 1 screw by the A/V jacks.
- 1 screw by the Fly-back assembly.

A-Board - Main Chassis

1. Slide the chassis completely out of the guide rails.
2. Stand the Receiver on its edge. The underside of the board is completely accessible for component replacement.

Note: *Some tie-wraps that secure the wire dressings may need to be unfastened for chassis removal.*

C-Board - CRT Output

Plugs into the socket on the CRT neck.

Z-Board - Pincushion Correction

Plugs into the A-Board.

Speakers

Speaker are secured to the speaker bracket with 4 screws, the bracket is secured to the cabinet's front with 2 screws.

Keyboard Push Button Assembly

Fastened to the inside of the cabinet front with up to 3 screws.

Disassembly for CRT Replacement

1. Discharge the CRT as instructed in the **Safety Precautions** (see page 2).
2. Disconnect the yoke (DY) plug, degaussing coil (DEG) plug and the CRT 2nd anode button from the main board.
3. Remove the C-Board from the CRT base and unplug the black wire (CRT dag ground) C10.
4. Disconnect the A11, A12, and Speakers plugs from the A-Board.
5. Lift the Main Chassis (A-Board) and all mounted boards completely out with the CRT Board attached.

CRT Replacement

1. Perform **Disassembly for CRT Replacement** procedure.
2. Insure that the CRT H.V. Anode button is discharged before handling the CRT. Read the **Safety Precautions** (see page 2) on handling the picture tube.
3. Remove the components from the CRT neck and place the cabinet face down on a soft pad.
4. Note the original order for the CRT mounting hardware as they are remove from the CRT mounting brackets at each corner of the CRT.
5. Remove the CRT with the degaussing coil and the dag ground braid attached.
6. Note the original locations and mounting of the degaussing coil and the dag ground assembly to insure proper reinstallation on the replacement CRT.

   To remove and re-mount the degaussing coil: The degaussing coil is held in place by clampers fastened to the CRT corner ears. These clampers must be installed onto the replacement CRT prior to mounting the degaussing coil.

   To remove and re-mount the dag ground braid:

   a. Unhook the coil spring from the bottom corners of the CRT ears.

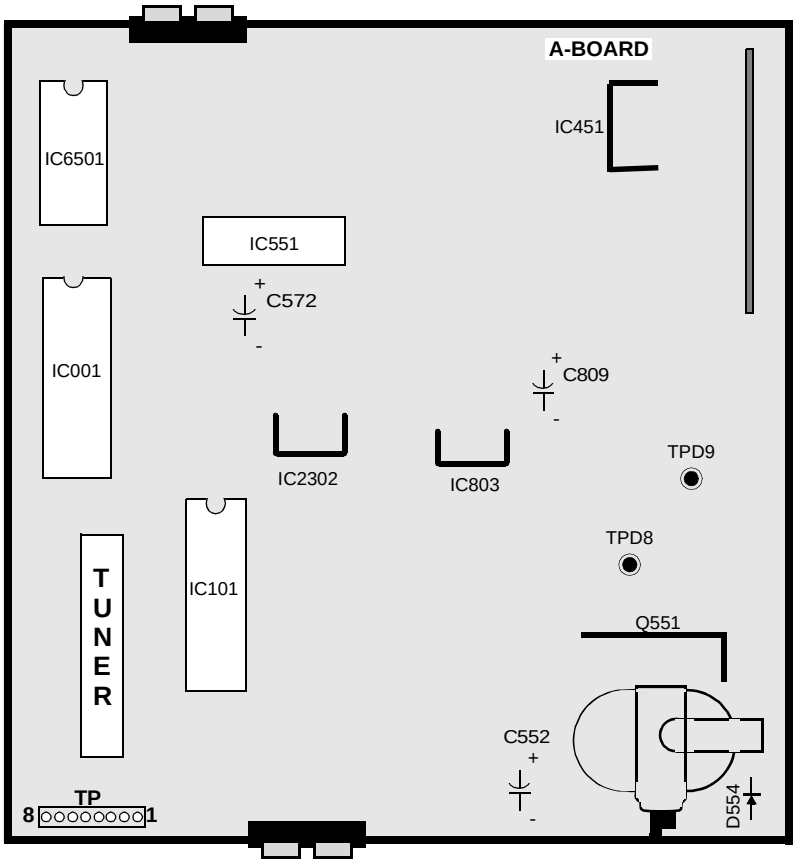
   b. Release the braid loop from the upper corners of the CRT ears.
7. Mount the dag ground braid on the replacement CRT. Position the degaussing coil with new ties. Dress coil as was on the original CRT.
8. Replace the components on CRT neck and reinstall into cabinet. Verify that all ground wires and circuit board plugs get connected.

Chassis Service Adjustment Procedures

All service adjustments are factory preset and should not require adjustment unless controls and/or associated components are replaced.

Note: *Connect the (-) lead of the voltmeter to the appropriate ground. Use IC803's heat sink when the HOT ground symbol (⏚) is used. Otherwise, use COLD ground (⏚) — Tuner shield, IC451's heat sink or FA2.*

Figure 4.
A-Board Main Components and Test Points



MOMENTARILY CONNECT A JUMPER FOR ENTERING SERVICE MODE (FA1 to FA2)

132.0V B+ Voltage Confirmation

1. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu.
2. Connect the DVM between C809(+ side) and cold ground (⏚).
3. Confirm that B+ voltage is **132.0V ± 2.5V**. This voltage supplies B+ to the Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu. Use cold ground (⏚) for the (-) lead of the DVM.

LOCATION	VOLTAGE
TPD8	24.0V ± 2V
TPD9	13.0V ± 2V
C552 (+) side	8.0V ± 1V
IC551 Pin3	9.0V ± 0.5V
D554 Cathode	200V ± 15V
C572 (+) side	5.0V ± 0.25V

Adjust Picture Menu for normalized video adjustments.

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears.
3. Confirm B+ 131V is within limit.
4. Using a high voltage meter confirm that the High Voltage is **27.7kV ± 1.25kV**.

Purity and Convergence Procedure

Adjustment is necessary only if the CRT or the deflection yoke is replaced or if the setting was disturbed. The complete procedure consists of:

1. Vertical Raster Shift Adjustment. **(Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings)**.
2. Initial static convergence.
3. Setting the purity.
4. Final static convergence.

When the CRT or the Yoke is Replaced

Place the yoke on the CRT neck (do not tighten the clamp).

For a 2-piece assembly (see Fig. 5):

Position purity/convergence assembly as shown and tighten clamp snugly. Remove the hot-melt glue seal on assembly and position like tabs of purity device together at 12 o'clock to reduce its magnetic field effect.

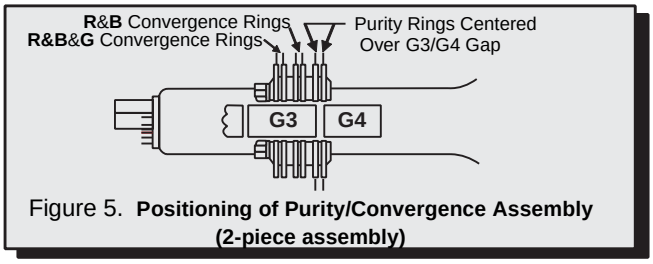


Figure 5. **Positioning of Purity/Convergence Assembly (2-piece assembly)**

For models using 4 pairs of rings, place the vertical raster shift tabs at 3 o'clock (90º from the purity and convergence tabs, see Fig. 6 and Fig. 7)

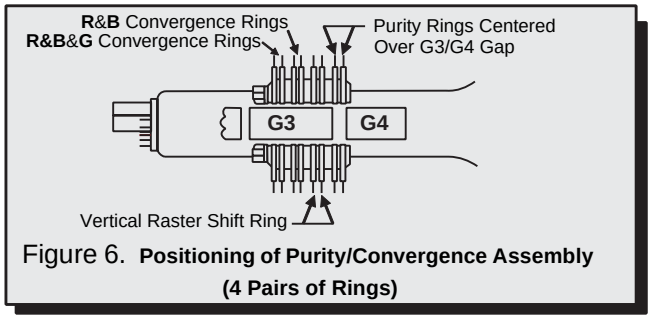


Figure 6. **Positioning of Purity/Convergence Assembly (4 Pairs of Rings)**

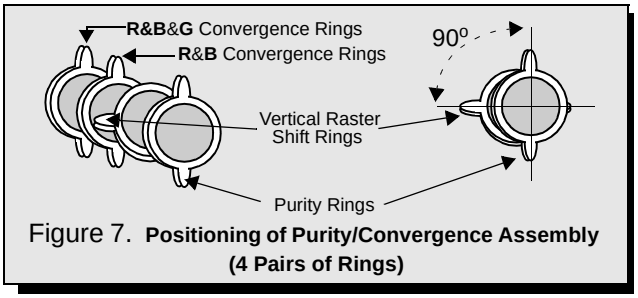


Figure 7. **Positioning of Purity/Convergence Assembly (4 Pairs of Rings)**

For a 1-piece assembly (see Fig. 8):

Position like tabs of purity devices together at 12 o'clock to reduce any magnetic field effect. (For better results, note part number and look for specifications at Service Center)

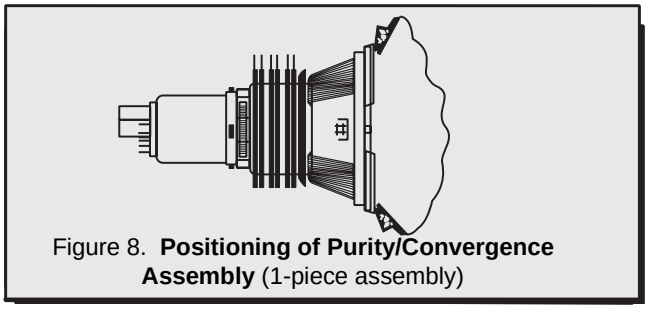


Figure 8. **Positioning of Purity/Convergence Assembly** (1-piece assembly)

For either assemblies:

Turn the Receiver ON. Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.

Fully degauss the Receiver by using an external degaussing coil.

Slide the deflection yoke back and forth on the neck of the CRT until it produces a near white, uniform raster.

Vertical Raster Shift Adjustment (Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings).

Apply a green pattern with a horizontal line, adjust the Deflection Yoke so that has no tilt, then secure it.

Adjust center line of the pattern with the mechanical center of the CRT, this center is determined by two marks at the side edges of the screen. To adjust the line, once the vertical raster shift tabs are place at 3 o'clock to reduce its magnetic field effect (see Fig. 6 and Fig. 7) open the tabs the same angle from the center, until the center line of the pattern becomes a straight line, centered with the marks of the CRT. (see Fig. 9)

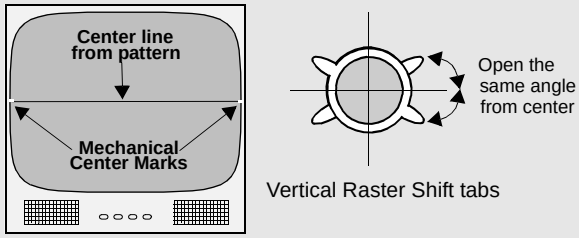


Figure 9. **Vertical Raster Shift Adjustment (4 pairs of rings assembly)**

Initial Center Static Convergence

Connect a dot/cross hatch generator to the Receiver and tune in a signal. Observe misconvergence at center of the screen only.
Adjust the R&B pole magnets; by separating tabs and rotating to converge blue with red.
Adjust the R&B and R&B&G pole magnets: by separating tabs and rotating to converge blue and red (magenta) with green.

Note: *Precise convergence at this point is not important.*

Purity Adjustment

When the Receiver is in the Service Mode for making electronic adjustments, press the **Recall** button on the Remote Control to enter Purity Check. (See the **Service Adjustments Electronic Controls** procedure).
Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.
Fully degauss the Receiver by using an external degaussing coil.
Press the **Recall** button on the Remote Control again until the Purity Check (green screen) appears.

For a 2-piece assembly (see Fig. 5)**:**
Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.
Adjust the Purity rings to set the vertical green raster precisely at the center of the screen (see Fig. 10).

NOTES:
1. CRT warm up with white screen (three guns activated) is needed to stabilize the shadow mask expansion.
2. Initial center static convergence (roughly centers three gun beams) is required in order to perform purity adjustment.

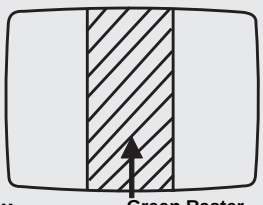


Figure 10. **Green Raster Adjustment**

Slowly move the deflection yoke forward until the best overall green screen is displayed.

For a 1-piece assembly (see Fig. 8)**:**
Slowly move the deflection yoke and purity rings assembly toward the CRT board and adjust the purity magnet rings to set vertical green raster at center of screen (see Fig. 10).
Gradually move the deflection yoke & purity rings forward and adjust for best overall green screen.

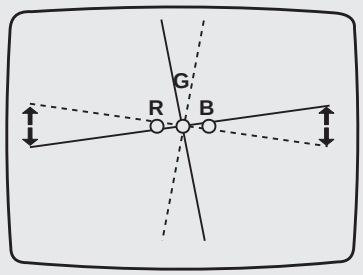
Continue from here for either assemblies:
Tighten the deflection yoke clamp screw.
Press the **Recall** button on the Remote Control again until the purity check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.
Press the **Recall** button on the Remote Control again until Purity check (white screen) appears. Observe the screen for uniform white. If purity has not been achieved, repeat the above procedure.

Final Convergence Procedure (see Fig. 11 through Fig. 13):

Note: *Vertical size and focus adjustments must be completed prior to performing the convergence adjustment. Connect a dot pattern generator to the Receiver. The* ***Brightness*** *level should not be higher than necessary to obtain a clear pattern.*
Converge the red and the blue dots at the center of the screen by rotating the R&B pole Static Convergence Magnets.
Align The converged red/blue dots with the green dots at the center of the screen by rotating the R&B&G pole Static Convergence Magnets. Melt wax with soldering iron to reseal the magnets.
Slightly tilt vertically and horizontally (do not rotate) the deflection yoke to obtain a good overall convergence.
If convergence is not reached at the edges, insert permalloy (see following section) from the DY corners to achieve proper convergence. Recheck for purity and readjust if necessary.
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.
Secure the deflection yoke by inserting two side wedges at 3 and 7 o'clock positions.
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over the tab to secure to the CRT.

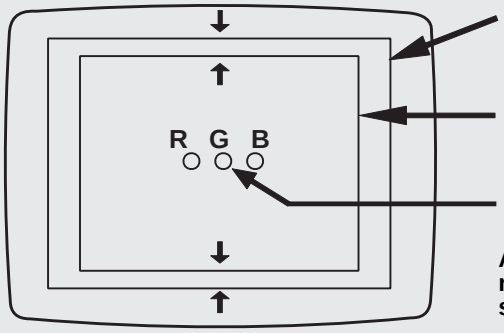
Permalloy Convergence Corrector Strip (Part No. 0FMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.
First converge the set without the strip and observe the corners.
If correction is needed:
1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.



As the yoke is tilted vertically, the rasters produced by the outside guns rotate in opposite directions.

Figure 11. **Vertical Yoke Movement**



Raster produced from one of the outside electron beams

Raster from the other side electron beam

Static convergence magnets are set for center convergence

As the yoke is tilted horizontally, one raster gets larger while the other gets smaller

Figure 12. **Horizontal Yoke Movement**

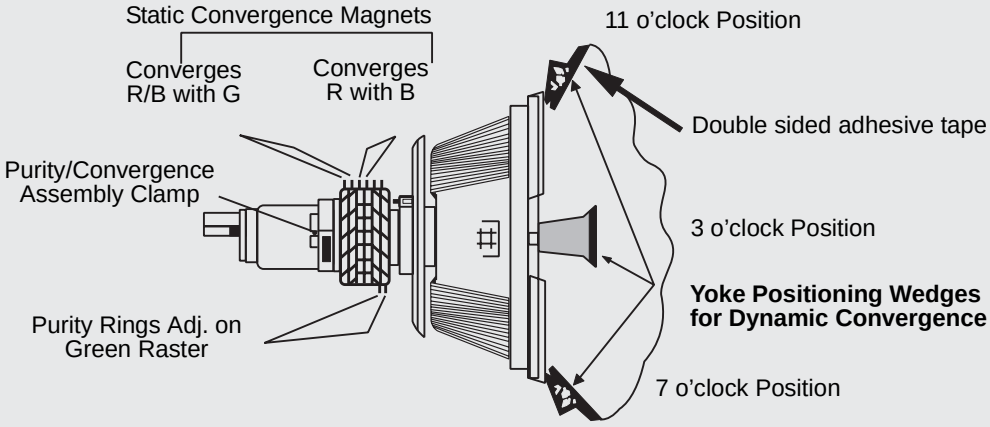


Figure 13. **Convergence Magnets and Wedges Location**

Note: *For models using 4 pairs of rings assemblies see Fig. 6 for details*

Service Mode (Electronic Controls)

This Receiver has electronic technology using the I²C Bus Concept. It performs as a control function and it replaces many mechanical controls. Instead of adjusting mechanical controls individually, many of the control functions are now performed by using “On Screen Display Menu”. (The **Service Adjustment Mode**.)

Note: *It is suggested that the technician reads all the way through and understand the following procedure for Entering/Exiting the **Service Adjustment Mode**; then proceed with the instructions working with the Receiver. When becoming familiar with the procedure, the Flow Chart for Service Mode may be used as a quick guide.*

Quick Entry to Service Mode:

At times when minor adjustments need to be done to the electronic controls, the method of Entering the service Mode without removal of the cabinet back is as follows using the Remote Control:

1. Select SET-UP icon and select CABLE mode.
2. Select TIMER icon and set SLEEP time for 30 Min.
3. Press ACTION button twice to exit menus.
4. Tune to the Channel 124.
5. Adjust VOLUME to minimum (0).
6. Press the VOL ◀ button (decrease) **on Receiver**. Red “CHK” appears in upper corner.

To toggle between Aging and Service modes:

While the “CHK” is displayed on the left top corner of the CRT, pressing the Action and the Volume Up buttons on the Receiver simultaneously will toggle between the modes. Red “CHK” for Service and yellow “CHK” for Aging.

7. **Press** the **Power** Button on the **Remote Control** to select one of six Service Adjustment Modes.
   1) **B**= Service VCJ SUB-DATA ADJUSTEMENT.
   2) **C**= Service VCJ CUT-OFF ADJUSTMENT.
   3) **S**= Service OPTIONS (PIP and CLOCK) ADJUSTMENT.
   4) **M**= Service MTS ADJUSTMENTS.
   5) **X** = Service COMB FILTER ADJUSTMENT.
   6) “**CHK**” = Normal operation of CHANNEL ▲▼ and VOLUME ◀ ▶.

Note: *Only the applicable settings for the Receiver serviced will be available (See* **a** *in Fig. 14).*

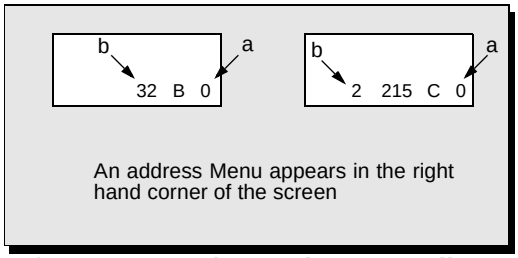


Figure 14. **Service Mode Menu Adjustments.**

Exiting the Service Mode:

Press the **Action** and the **Power** buttons on the **Receiver** simultaneously for at least 2 seconds.

THE RECEIVER EXITS SERVICE MODE.

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound. Any programmed channels, channels caption data and some others user defined settings will be erased.

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

Press the **Power Button** on the **Remote Control** to select the Service Adjustment.

For Adjustments:

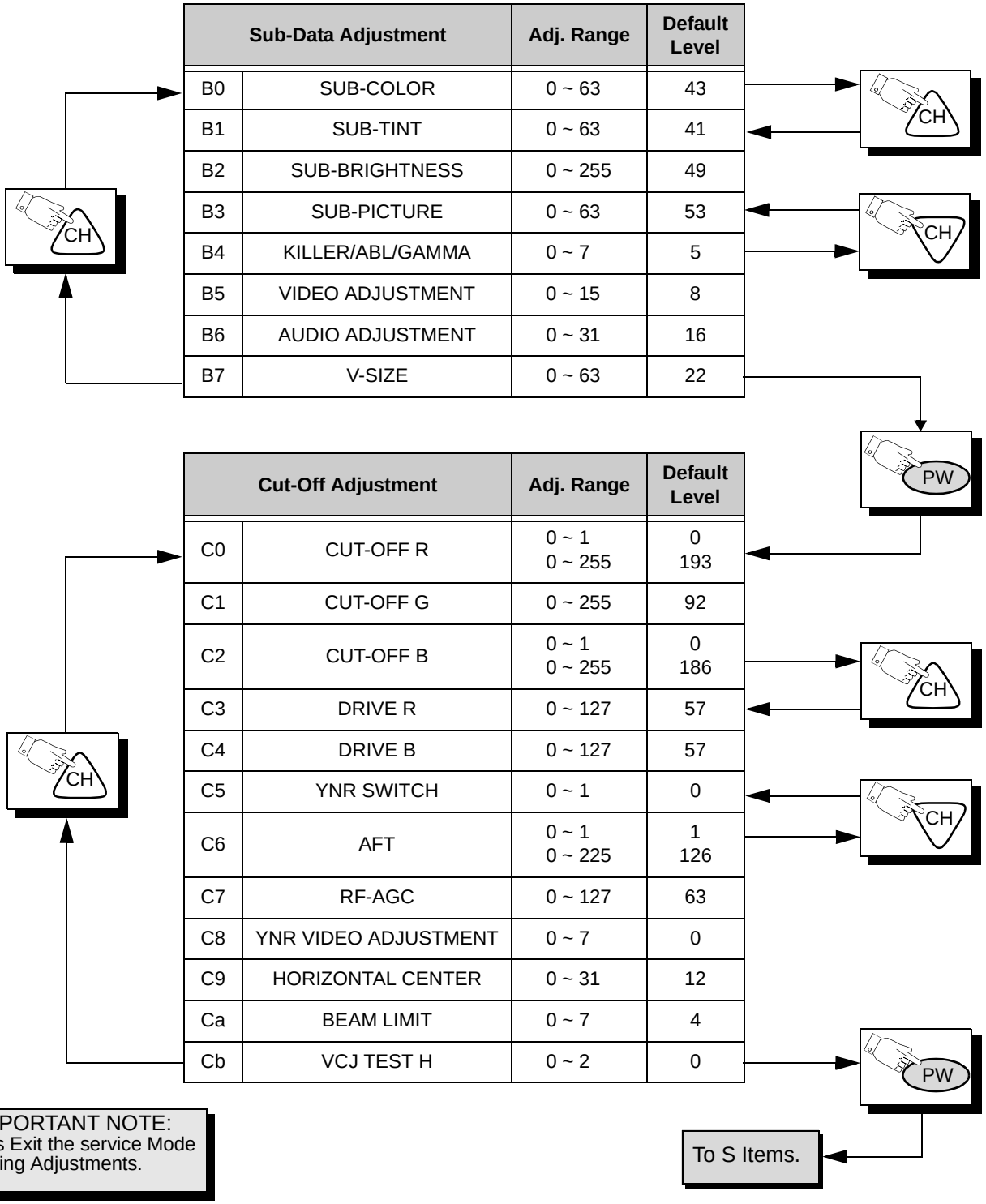
1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 14).

Note: *Write Down the original value set (**b** in* Fig. 14*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 14).

Sub-Data Adjustment		Adj. Range	Default Level
B0	SUB-COLOR	0 ~ 63	43
B1	SUB-TINT	0 ~ 63	41
B2	SUB-BRIGHTNESS	0 ~ 255	49
B3	SUB-PICTURE	0 ~ 63	53
B4	KILLER/ABL/GAMMA	0 ~ 7	5
B5	VIDEO ADJUSTMENT	0 ~ 15	8
B6	AUDIO ADJUSTMENT	0 ~ 31	16
B7	V-SIZE	0 ~ 63	22

Cut-Off Adjustment		Adj. Range	Default Level
C0	CUT-OFF R	0 ~ 1 0 ~ 255	0 193
C1	CUT-OFF G	0 ~ 255	92
C2	CUT-OFF B	0 ~ 1 0 ~ 255	0 186
C3	DRIVE R	0 ~ 127	57
C4	DRIVE B	0 ~ 127	57
C5	YNR SWITCH	0 ~ 1	0
C6	AFT	0 ~ 1 0 ~ 225	1 126
C7	RF-AGC	0 ~ 127	63
C8	YNR VIDEO ADJUSTMENT	0 ~ 7	0
C9	HORIZONTAL CENTER	0 ~ 31	12
Ca	BEAM LIMIT	0 ~ 7	4
Cb	VCJ TEST H	0 ~ 2	0



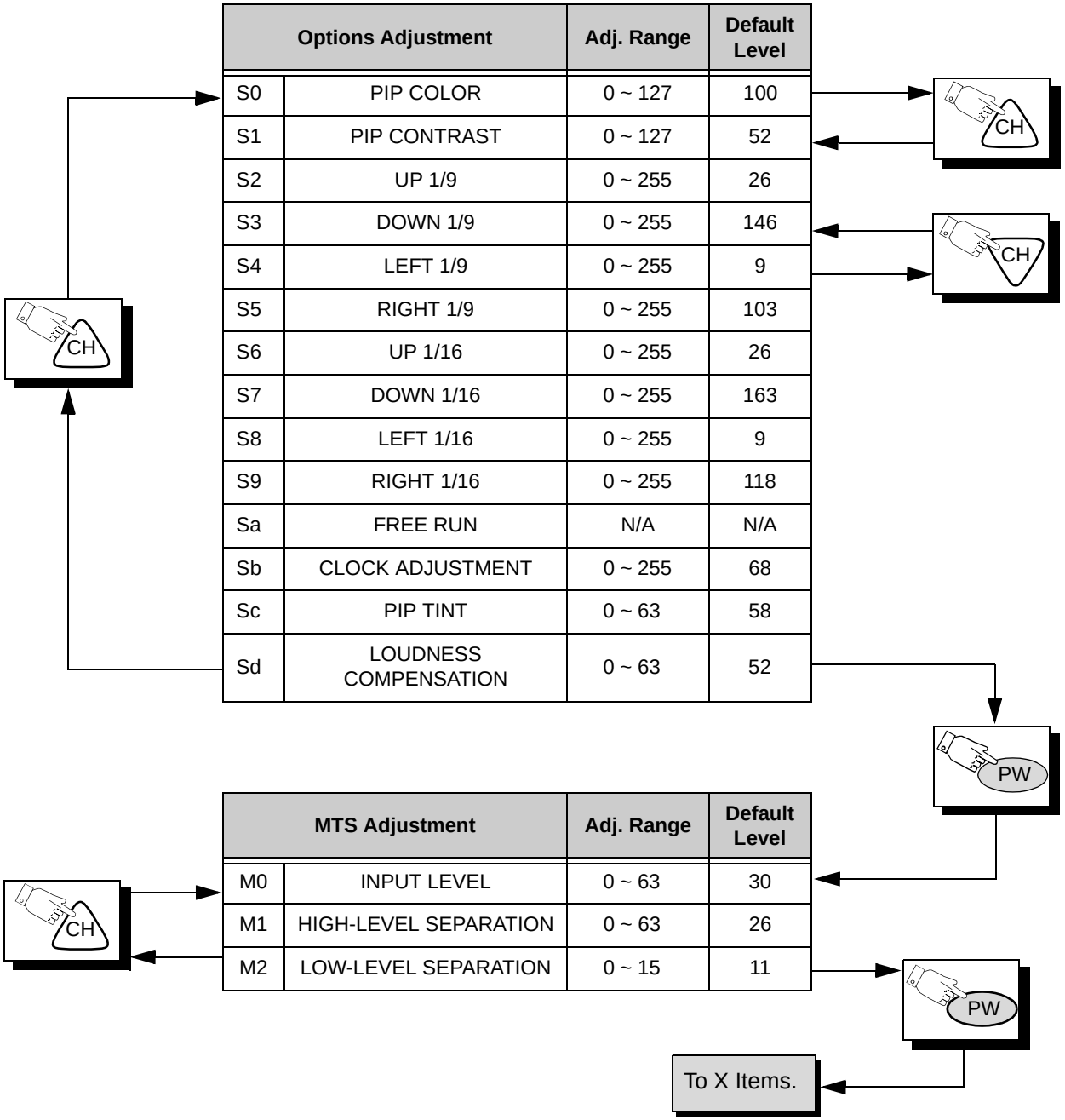
Press the Power Button on the Remote Control to select the Service Adjustment

For Adjustments:

1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 14).

Note: *Write Down the original value set (**b** in* Fig. 14*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 14).



Options Adjustment		Adj. Range	Default Level
S0	PIP COLOR	0 ~ 127	100
S1	PIP CONTRAST	0 ~ 127	52
S2	UP 1/9	0 ~ 255	26
S3	DOWN 1/9	0 ~ 255	146
S4	LEFT 1/9	0 ~ 255	9
S5	RIGHT 1/9	0 ~ 255	103
S6	UP 1/16	0 ~ 255	26
S7	DOWN 1/16	0 ~ 255	163
S8	LEFT 1/16	0 ~ 255	9
S9	RIGHT 1/16	0 ~ 255	118
Sa	FREE RUN	N/A	N/A
Sb	CLOCK ADJUSTMENT	0 ~ 255	68
Sc	PIP TINT	0 ~ 63	58
Sd	LOUDNESS COMPENSATION	0 ~ 63	52

MTS Adjustment		Adj. Range	Default Level
M0	INPUT LEVEL	0 ~ 63	30
M1	HIGH-LEVEL SEPARATION	0 ~ 63	26
M2	LOW-LEVEL SEPARATION	0 ~ 15	11

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

Press the Power Button on the Remote Control to select the Service Adjustment

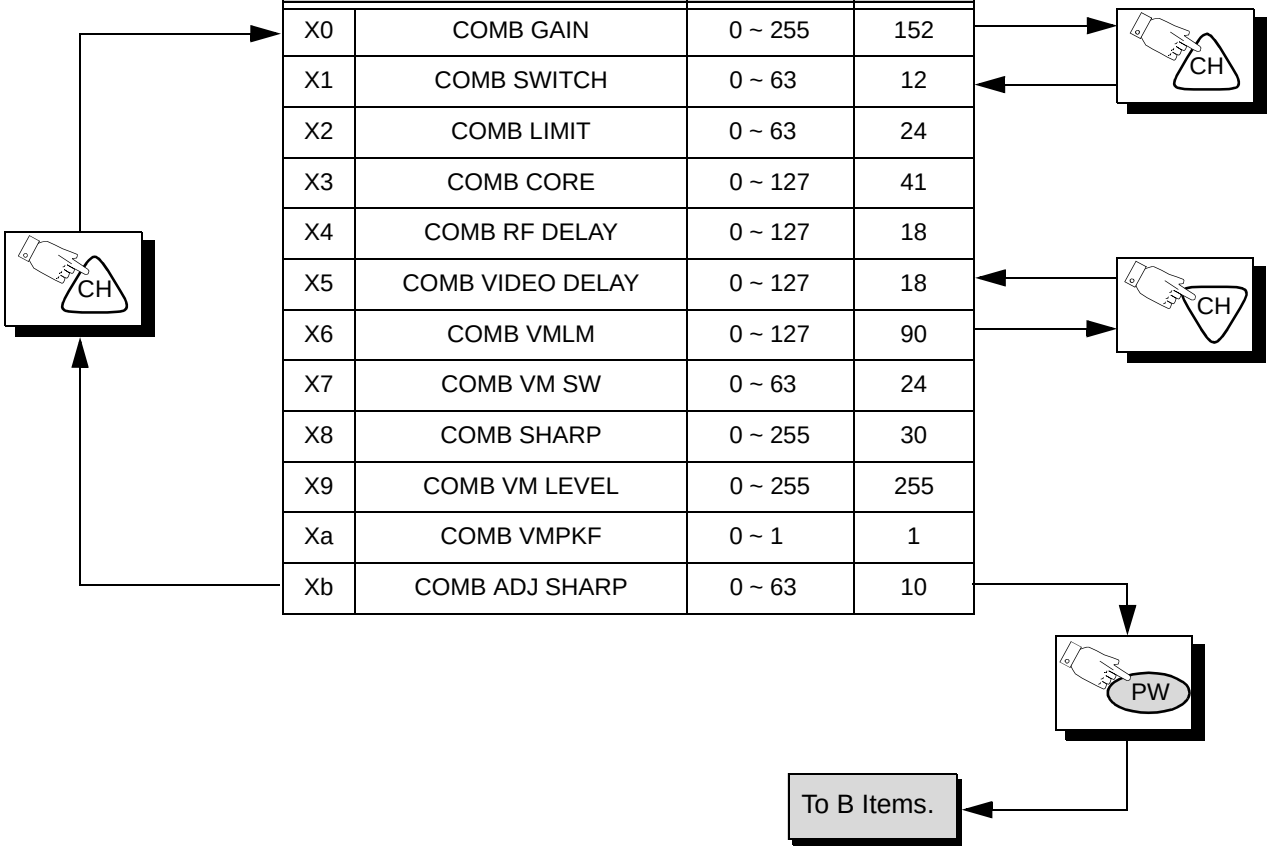
For Adjustments:

1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 14).

Note: *Write Down the original value set (**b** in* Fig. 14*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 14).

Comb Filter Adjustment		Adj. Range	Default Level
X0	COMB GAIN	0 ~ 255	152
X1	COMB SWITCH	0 ~ 63	12
X2	COMB LIMIT	0 ~ 63	24
X3	COMB CORE	0 ~ 127	41
X4	COMB RF DELAY	0 ~ 127	18
X5	COMB VIDEO DELAY	0 ~ 127	18
X6	COMB VMLM	0 ~ 127	90
X7	COMB VM SW	0 ~ 63	24
X8	COMB SHARP	0 ~ 255	30
X9	COMB VM LEVEL	0 ~ 255	255
Xa	COMB VMPKF	0 ~ 1	1
Xb	COMB ADJ SHARP	0 ~ 63	10



Note: *Some adjustments modes may not be available in some models depending on available options.*

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

To Check Purity:

Press the **Recall** Button on the **Remote Control** when in Service Mode (red “CHK” is displayed) to enter the Purity Field Check Mode.

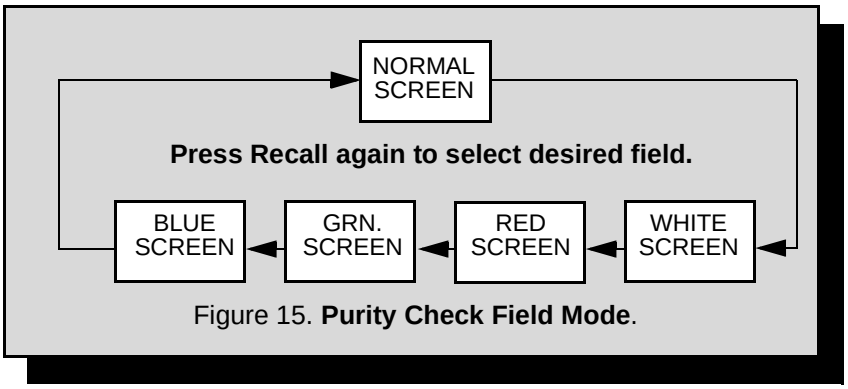


Figure 15. **Purity Check Field Mode**.

Helpful Hints

Entering Service Mode (Back-Open Method)

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point **FA1** (TP8) to Cold Ground (⏚) **FA2** (TP3) A-Board.
   The Receiver enters the Aging Mode.
   Yellow letters “CHK” appear in the upper left corner of the CRT.
   (The Volume Up/Down will adjust rapidly).
2. Simultaneously press the **Action** and the **Volume Up** buttons on the **Receiver** Control Panel.
   The Receiver enters the Service Mode.
   The letter in “CHK” turn red.
   (The Volume Up/Down will adjust normally).
   (All customer controls are set to nominal level).

IMPORTANT NOTE:
Always Exit the Service Mode Following Adjustments.

Instructional Flow Chart for Service Mode

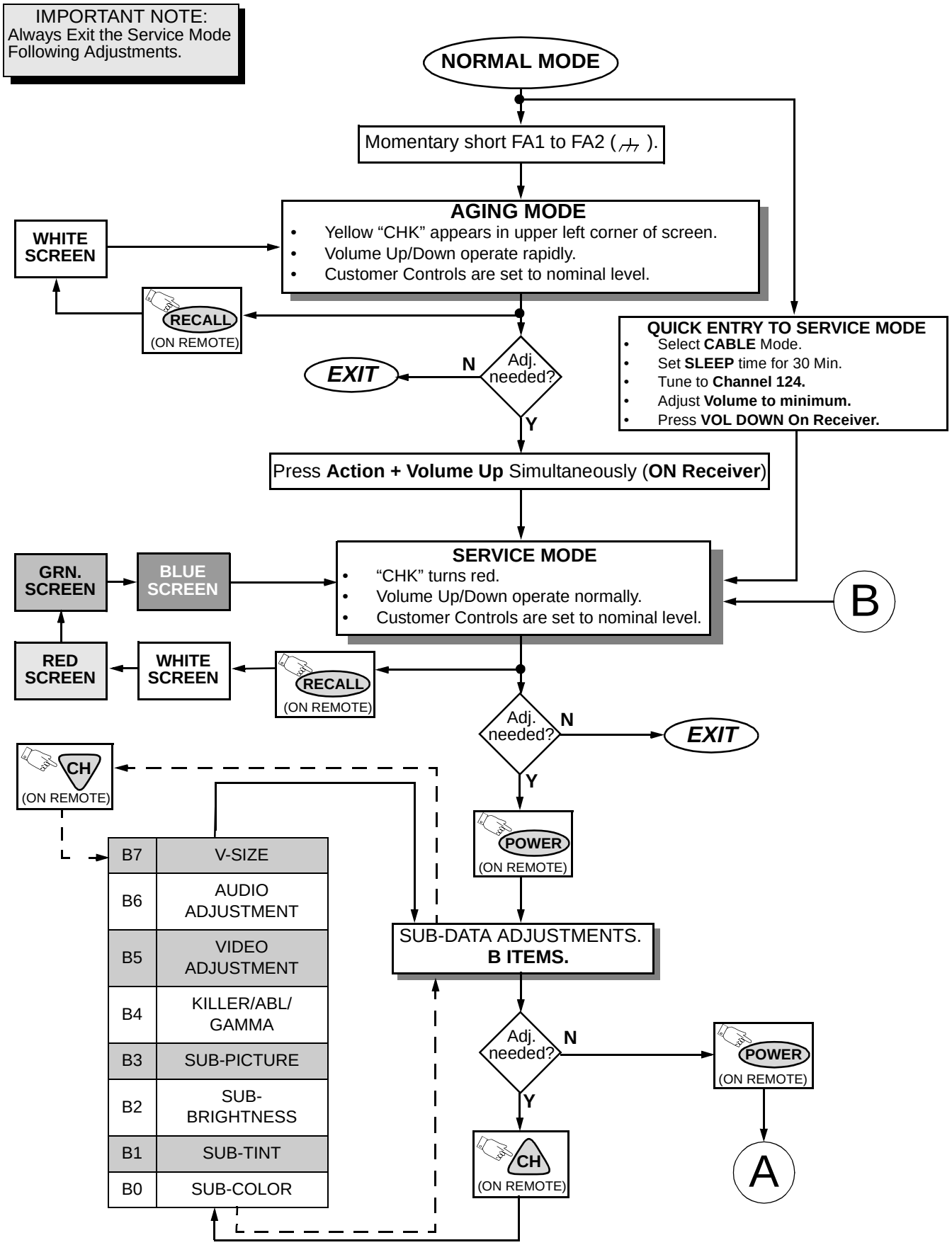


Figure 16.**Flow Chart for Service Mode**.

Instructional Flow Chart for Service Mode - Continued

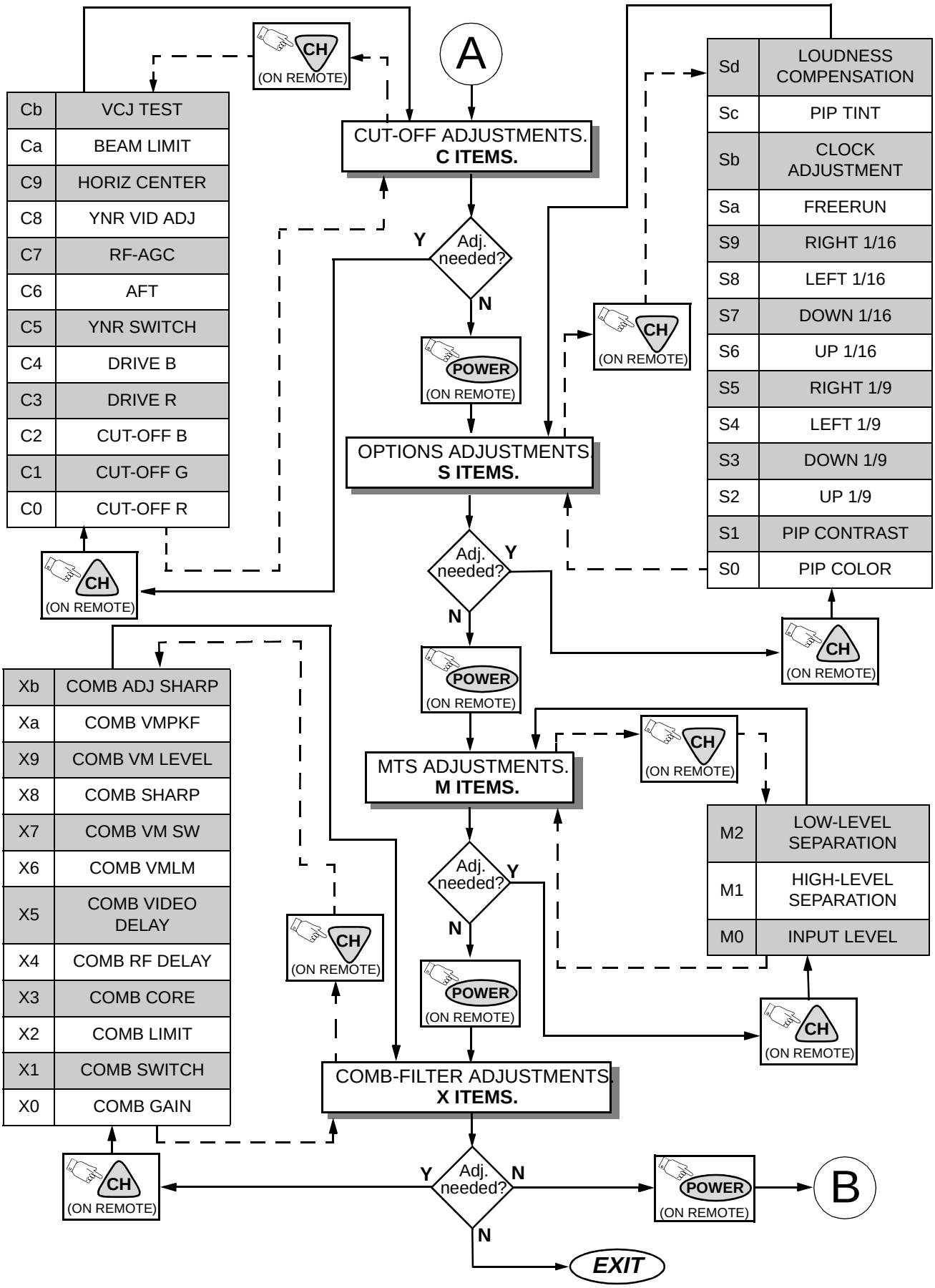


Figure 17. **Flow Chart for Service Mode**.(Continued)

Service Adjustments (Electronic Controls)

Sub-Brightness

Service DAC Adjustment (B2)

Adjustment of this control is important for setting proper operation of customer brightness and picture controls. This adjustment must be made after Sub-Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after the Sub-Brightness is set.

Preparation:

Apply a color bar signal wit 100 IRE white and 7.5 IRE black. (Switch Color to "OFF" on the signal generator.) Operate the Receiver for a minimum of 10 minutes prior to performing this adjustment.

Procedure:

In the Service Mode for making electronic adjustments, select the DAC adjustment (B2) and adjust until the black starts to look gray. Then decrease the level to the point where gray turns to black.

Note: *You may set the accurate value following the Preparation steps and the Procedure step No. 2 of the Sub-Contrast adjustment described below.*

Video Adjustment Level

Service DAC Adjustment (B5)

Preparation:

1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect the oscilloscope to TP12. Use cold ground for scope connection. Set the scope at Horizontal Sweep rate (20µs) time base.

Procedure:

1. In the Service Mode for making electronic adjustments, select DAC Video Adjustment Level (B5) and adjust for **1.0±0.05V** from sync tip to white level. See Fig. 18.

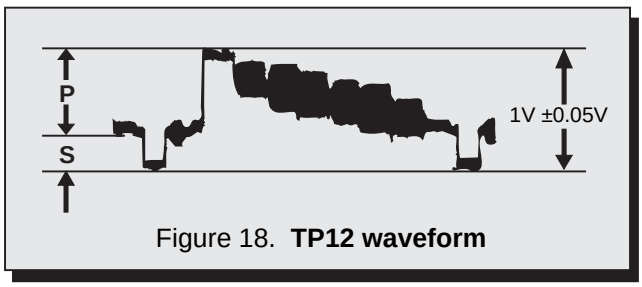


Figure 18. **TP12 waveform**

2. Check that the sync signal amplitude (ratio between the sync signal to detection output) is within the range of 30 ±5% (S/(S+P) = 30 ±5%).
3. Set the DAC Sub-Contrast Adjustment (B3).

Sub-Contrast

Service DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or when the CRT is replaced.

Preparation:

1. Apply a color bar signal pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

Note: *The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to the pattern used if another signal is used.*

2. Preset the following controls:
   - Brightness . . . . . .Center.
   - Color . . . . . .Min.
   - Picture . . . . . .Max.
   - Sharpness . . . . . .Center.
3. Connect the oscilloscope to the CRT-Board connector C1-2. Set the scope time base to 20µs (horizontal).
4. Connect a jumper from TPD2 to ground (⏚).
5. Connect a jumper from IC101 pin 28 to ground (⏚).

Procedure:

1. In the Service Mode, select DAC Sub-Brightness Adjustment (B2) and adjust for **1.0-1.5Vp-p** between blanking and 7.5 IRE level. (See video waveforms detail, Fig. 19).

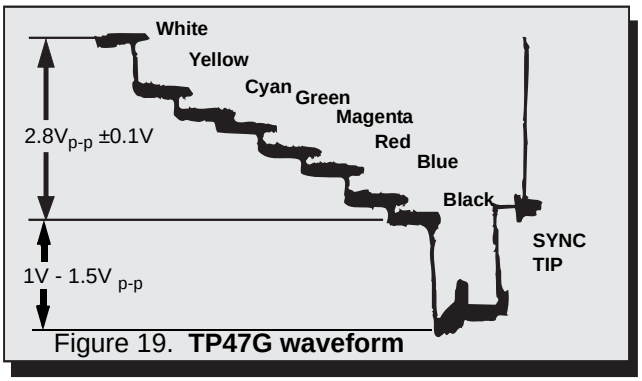


Figure 19. **TP47G waveform**

2. In the Service Mode for electronic adjustments, select DAC Sub-Contrast Adjustment (B3) and adjust for **2.8Vp-p ±0.1V** for 27" models from white level to black level on video waveform (see video waveforms detail, Fig. 19).
3. Remove the jumpers (Preparation steps 4 & 5).

Tint/Color Adjustment

Service DAC Adjustment (B1) (B0)

Preparation:

1. Apply a rainbow color bar signal.
2. Preset the following controls:
   - Brightness . . . . . .Min.
   - Color . . . . . .Center.
   - Tint. . . . . .Center.
   - Picture . . . . . .Max.
   - Sharpness . . . . . .Min.
3. Connect the oscilloscope to TP47B (A-Board).
4. Connect a jumper from TPD2 to GND (⏚).
5. Connect a jumper from IC101 pin 28 to GND (⏚).

Service Adjustments (Electronic Controls, cont.)

Procedure:

1. In the Service Mode for making electronic adjustments, select DAC Sub-Tint Adjustment (B1). Adjust until the waveform measured is as the one shown in Fig. 20.

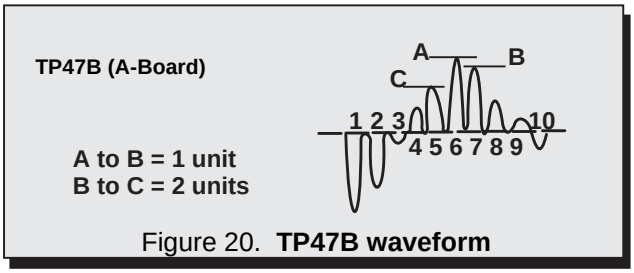


Figure 20. **TP47B waveform**

2. Connect the oscilloscope to TP47G (A-Board).
3. Select DAC Sub-Color Adjustment (B0) and adjust for peak to peak amplitude to be **0.9Vp-p ±0.05V** for 27" models as shown in Fig. 21.

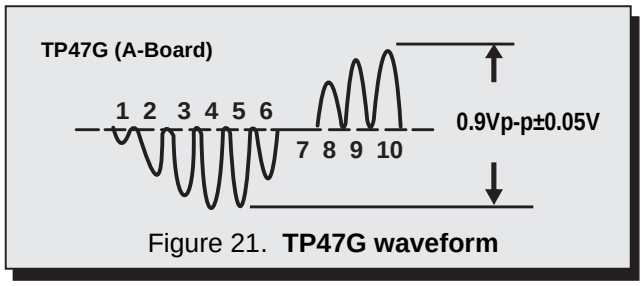


Figure 21. **TP47G waveform**

4. Remove the jumpers (Preparation steps 4 & 5).

Color Temperature Adjustment (B/W Tracking)

Service DAC Adjust. (C0) (C1) (C2) (C3) (C4)
Minor Touch-Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good gray scale and warm highlights".

1. LOW LIGHT areas – In Service Mode for making electronic adjustments, select Cutoff (C0) RED, (C1) GRN, (C2) BLU and adjust the picture for gray.
2. HIGH LIGHT areas – In Service Mode for making electronic adjustments, select Drive (C3) RED, (C4) BLU and adjust the picture for warm whites.

Complete Adjustment

Preparation:

1. Turn the Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply a color bar signal with color "OFF".
3. Turn the SCREEN control (part of FBT T551) fully counterclockwise.

Procedure:

Preset the following Service DACs for best results:

- C0. . . . . 0 128
- C1. 64
- C2. . . . . 0 128
- C3. 64
- C4. 64

1. Connect the oscilloscope to C1-2 (CRT-Board).
2. In Service Mode for making electronic adjustment, select the Sub-Bright DAC (B2).
3. Press the R-Tune key on the remote.
4. Observe the oscilloscope waveform at Horizontal rate and adjust the Service Mode Sub-Bright DAC (B2) level until a scanning period of **3.1V** above DC ground is measured, as indicated in Fig. 22.

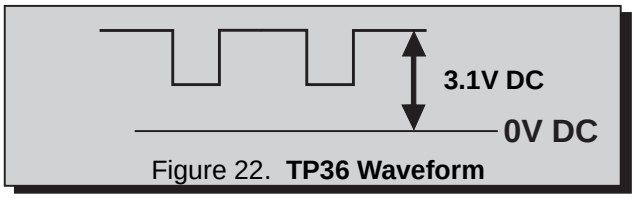


Figure 22. **TP36 Waveform**

5. Connect the scope to GRN Cathode (KG) on the CRT-Board.
6. In the Service Mode for making electronic adjustments, select the GREEN CUTOFF DAC (C1).
7. Press the R-Tune key on the remote.
8. View scope trace at Horizontal rate and adjust the Service Mode DAC (C1) level until a scanning period of **160V** above DC ground is measured, as indicated in Fig. 23.

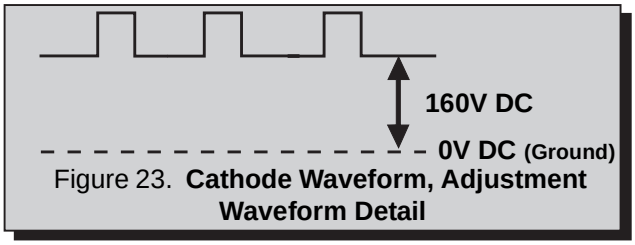


Figure 23. **Cathode Waveform, Adjustment Waveform Detail**

9. Connect the scope to the RED Cathode (KR).
10. In Service Mode for making electronic adjustments, select the RED CUTOFF DAC (C0).
11. Press the R-Tune key on the Remote
12. View the scope trace and adjust the Service Mode DAC (C0) for the scanning period to be **160V** above DC ground. (See Fig. 23)
13. Connect the scope to the BLU Cathode (KB).
14. In Service Mode for making electronic adjustments, select the BLU CUTOFF (C2).
15. Press the R-Tune key on the Remote.
16. View the scope trace and adjust the Service Mode DAC (C2) for the scanning period to be **160V** above DC ground. (See Fig. 23)
17. Turn the Screen Control (part of FBT) slowly clockwise until a color horizontal line appears.
18. With the other two colors Service Mode DAC CUTOFF adjustments (C0) RED, (C2) BLU; increase the colors to create a white horizontal line.
19. Confirm that a good gray scale is established by viewing B/W color bar pattern.

Service Adjustments (Electronic Controls, cont.)

20. In the Service Mode for making electronic adjustments select the DAC DRIVE adjustments (C3) RED, (C4) BLUE and adjust for warm white in a white color bar pattern.
21. EXIT the Service Mode.
22. Adjust the Picture Menu Video Adjustments **Bright** and **Picture** from low scale to high scale and check Black and White tracking.
23. If correction is needed: Re-Enter the Service Mode and perform the **Minor Touch – Up Method.**
24. Perform **Sub-Brightness** Adjustment procedure if needed.

Horizontal Centering

Service DAC Adjustment (C9)

Preparation:

Connect a monoscope pattern.

Procedure:

1. In the Service Mode for making electronic adjustments. Select the Horizontal Centering Adjustment DAC (C9) and adjust until the center of the crosshatch pattern is centered on CRT.
2. EXIT the Service Adjustment Mode.

Audio Adjustment

Service DAC Adjustment (B6)

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

Preparation:

1. Apply the following signal at the antenna (70dB ±5dB, 75Ω open P/S 10dB): audio signal set to monaural, 300Hz. 100% modulation; video input of 100 IRE flat field, 30% modulation.
2. Connect the RMS Meter with filter jig as shown in Fig. 24.

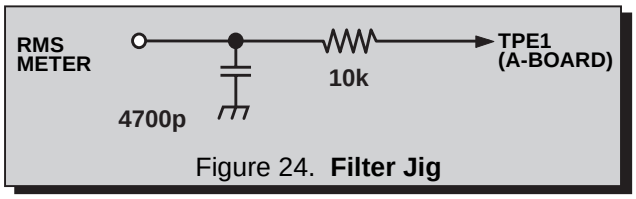


Figure 24. **Filter Jig**

Procedure:

1. In the Service Mode for making electronic adjustments, select the Audio Adjustment DAC (B6) and adjust until 75mV RMS ±5.0mV RMS is measured.
2. EXIT the Service Adjustment Mode.

MTS Circuit Adjustments

The MTS Circuit Adjustments require two steps:

1. Input Level Adjustment.
2. Stereo Separation Adjustment.

Input Level Adjustment (M0)

Preparation:

1. Connect an RMS meter with filter jig as shown in Fig. 25.

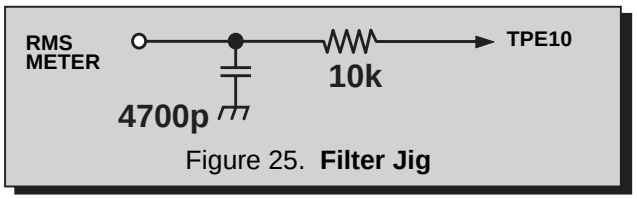


Figure 25. **Filter Jig**

2. Connect an RF signal generator to the RF antenna input.

Procedure:

1. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 300Hz, 100% modulation, monaural (70 ±5dB, 75Ω OPEN, P/S 10dB).
2. Adjust the MTS Input Level Adjustment (M0) until the voltage measured is 106 ± 6.0mV rms.

Stereo Separation Adjustment (M1 & M2)

Preparation:

1. Connect an RF signal generator to the RF antenna input.
2. Connect a scope to TPE10.

Procedure:

1. Select Stereo Mode in Audio menu
2. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 300Hz, 100% modulation, stereo (left only) (70 ±5dB, 75Ω OPEN, P/S 10dB).
3. Adjust the MTS Low-Level Separation Adjustment (M2) until the amplitude displayed on the scope is minimum.
4. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 3KHz, 100% modulation, stereo (left only) (70 ±5dB, 75Ω OPEN, P/S 10dB).
5. Adjust the MTS High-Level Separation Adjustment (M1) until the amplitude displayed on the scope is minimum
6. .Repeat above steps 2 through 5 until the amplitude is at minimum for both signals.Service Adjustments (Electronic Controls, cont.)

Clock Adjustment (Sb)

Preparation:

Connect the frequency counter from TPS1 (IC001 Pin 13) to cold ground (⏚).

Note: *Frequency Counter probe capacitance should be 8pF or less.*

Procedure:

1. Turn the Receiver "OFF" with the AC power applied.
2. Measure TPS1 (IC001 pin 13) for the frequency of the waveform and record the reading.

Note: *Pin 13 measurement must have at least four digits of resolution following the decimal point. Example: 000.0000*

3. Turn the Receiver back "ON".
4. Place the Receiver into Service Mode for making electronic adjustment, select the Clock Adjustment DAC (Sb).
5. Calculate and set Sb based on the following formula:

$$Sb = 128 + 0.901 \times 10^{6\{\frac{244.1406 - pin13[Hz]}{244.1406}\}}$$

Note: *Pin 13 measurement will not change regardless of the value stored in Sb.*

Vertical Size (B7)

1. Adjust the VERTICAL SIZE DAC control, B7, until the top and the bottom edges of the raster are visible.
2. Adjust the VERTICAL SIZE control, B7, until the top and the bottom of the raster touch the bezel edge. The advance SIZE control to obtain an approximately 10% overscan. Linearity adjustment is done automatically when the size is being adjusted. (Best results can de obtained with a round test patter.)

Service Adjustments (Mechanical Controls)

VCO Field Alignment L105 (IC101 pins 35 & 36)

1. Connect a balance antenna and select a midband channel (Ch 10, 11 or 12)
2. Attenuate the signal strength for a weak noisy video.
3. While observing the picture tube, adjust L105 until best picture appears.
4. Change channels and observe that they are tuning properly.
5. If the channel monitored is not clear, repeat steps 1, 3 and 4 while applying a stronger signal.

Focus (part of T551)

Preparation:

Connect a Signal generator and select a do tpattern.

Procedure:

Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.

a. Adjust for best center.
b. Adjust for best area between the center and top right corner.

E-W Pincushion

Perform H-Centering adjustment to confirm correct picture centering.

Preparation:

Apply a crosshatch pattern.

Procedure:

Adjust E-W Pincushion by adjusting R761 on Z-Board until outside vertical lines are as straight as possible.

H- Width Adjustment

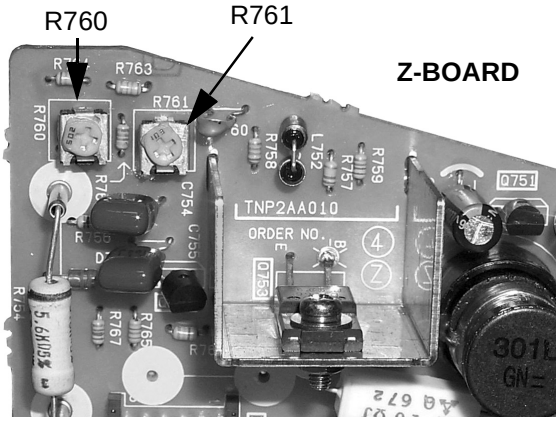
Perform H-Centering adjustment to confirm correct picture centering.

Preparation:

Apply a monoscope pattern.

Procedure:

Adjust R760 and B7 until obtain a perfect round pattern on the screen.



Audio Signal Path Block Diagram

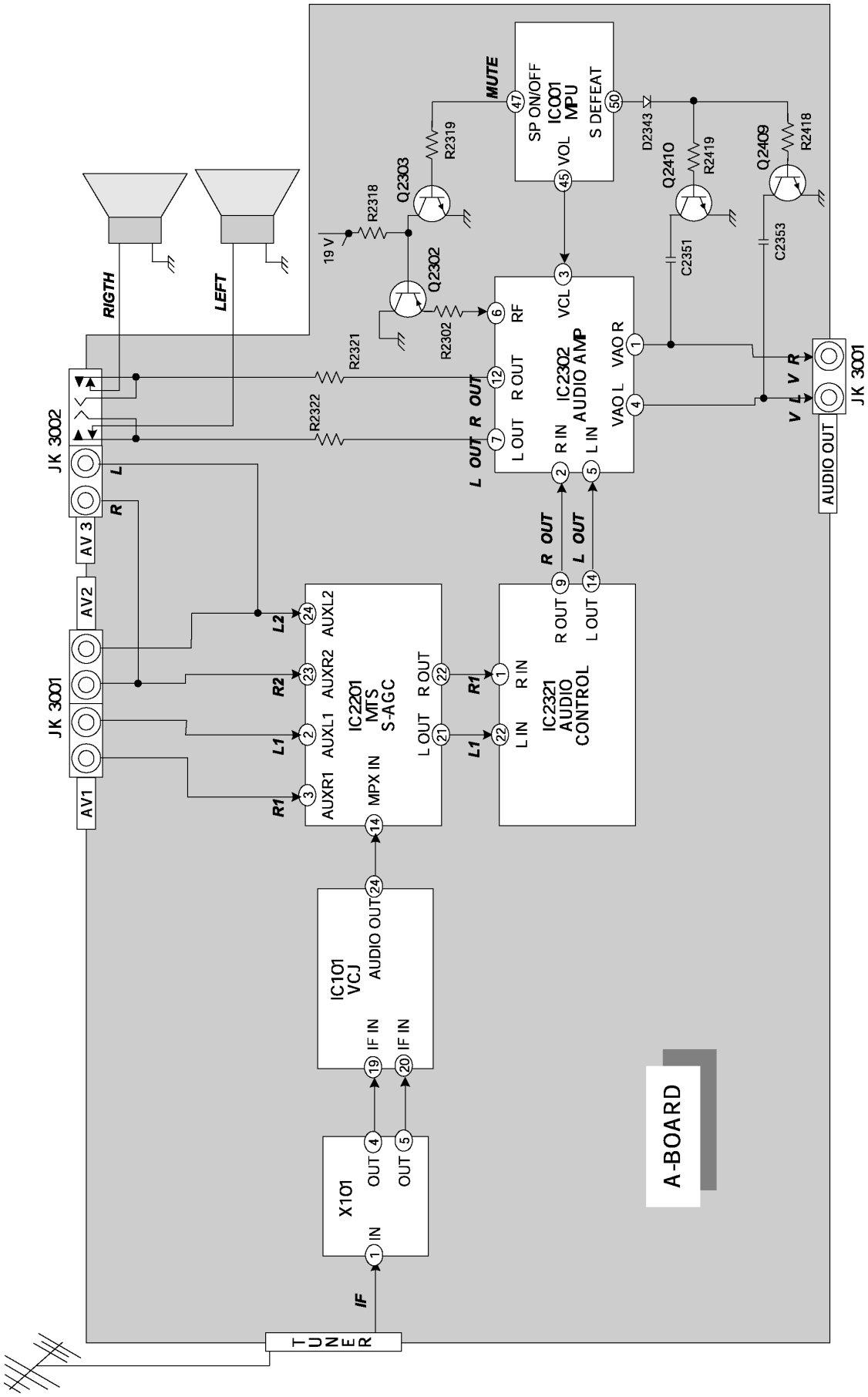


Figure 26. **Audio Signal Path Block Diagram.**

Video-Chroma Signal Path Block Diagram

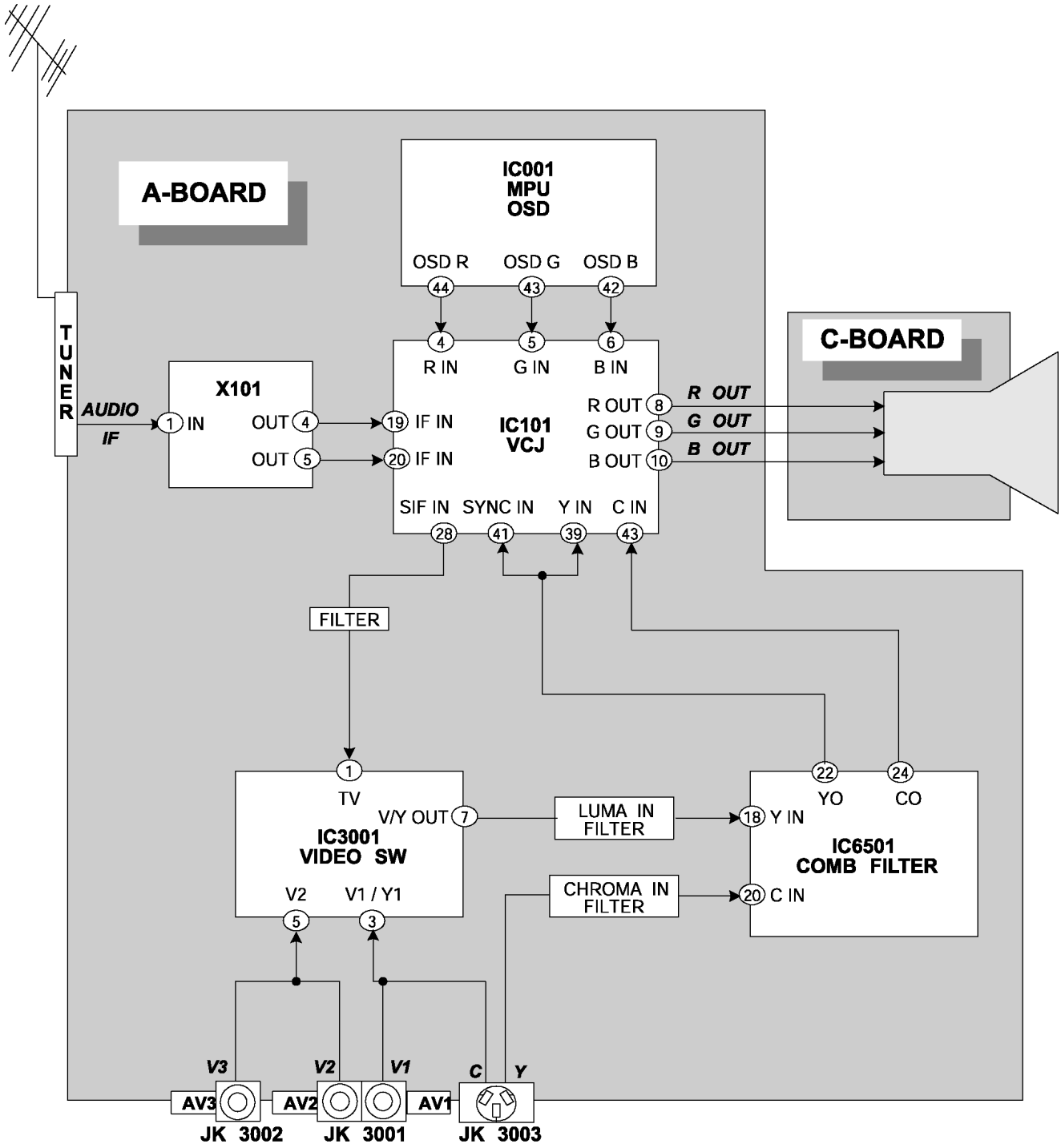


Figure 27. **Video-Chroma Path Block Diagram.**

Identification of Components

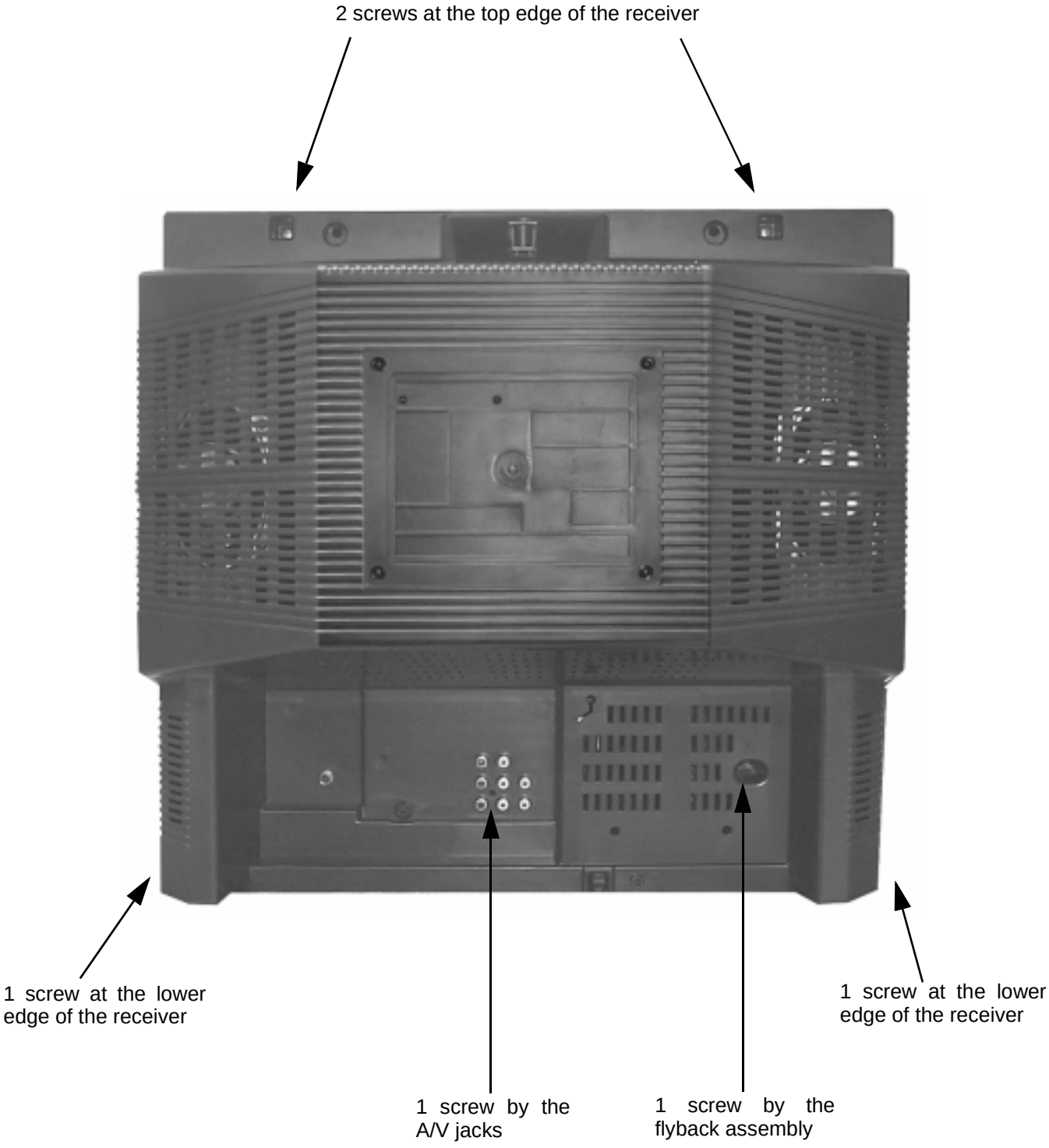
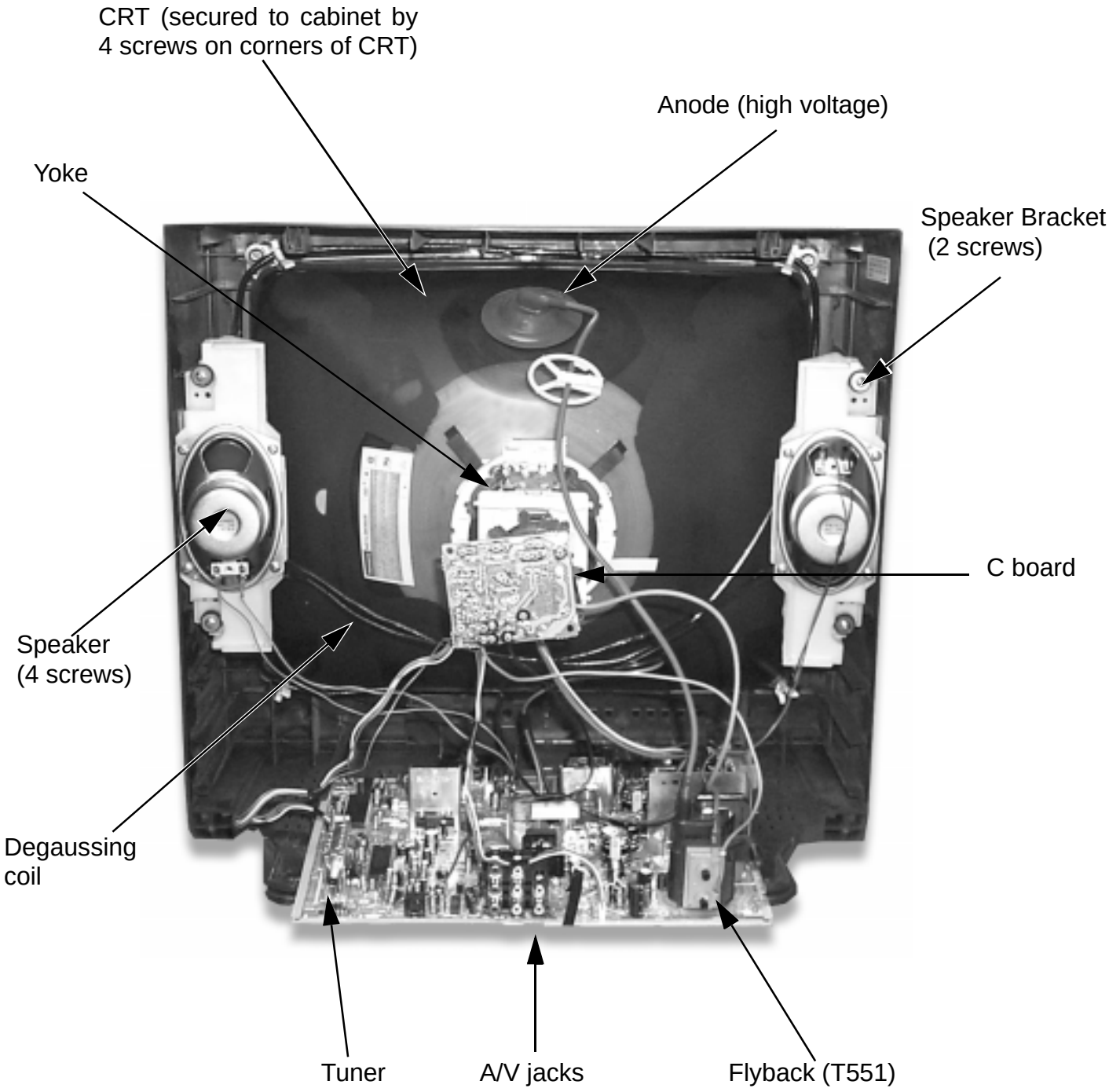

2 screws at the top edge of the receiver
1 screw at the lower edge of the receiver
1 screw at the lower edge of the receiver
1 screw by the A/V jacks
1 screw by the flyback assembly

Figure 28. **Back Cover Removal**

Identification of Components



Note: After servicing the receiver, remember to dress the cables, as shown.

Figure 29. **Rear View**

Identification of Components

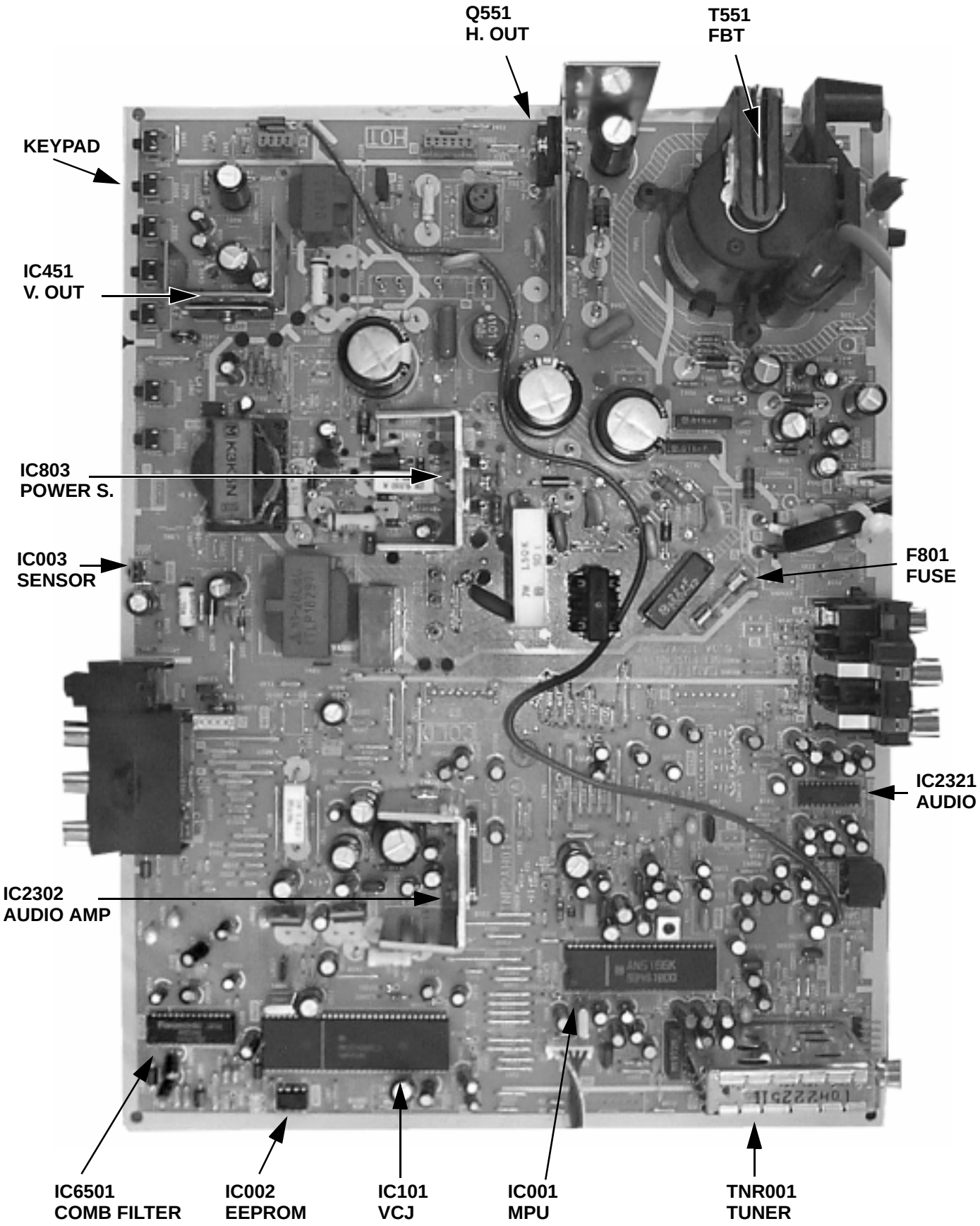


Figure 30. **A-Board Main Components**

Identification of Components

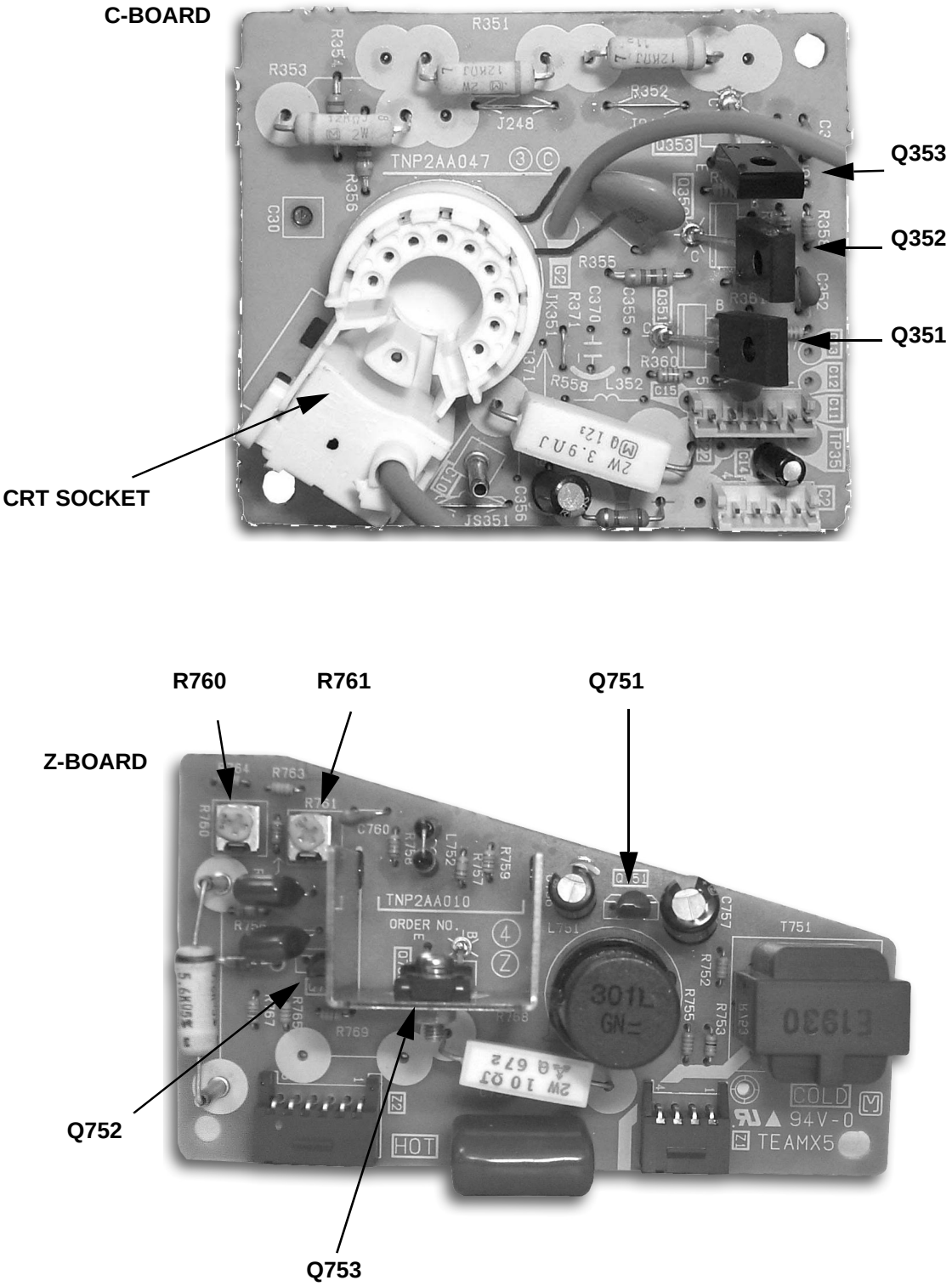


Figure 31. Component Identification, C&Z Boards

REPLACEMENT PARTS LIST

Model:CT-20SX11E/CE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C604	TCJ2VU1H150J	CAP,C 15PF-J-50V
C605	TCJ2VB1H332K	CAP,C .0033UF-K-50V
C606	ECA1HM010B	CAP,E 1UF-50V
C754	ECQB1H104JFW	CAP,P .1UF-J-50V
C755	ECQB1H104JFW	CAP,P .1UF-J-50V
C756	ECA1CM221B	CAP,E 10UF-16V
C757	ECA1VM221B	CAP,E 220UF-35V
C759	**ECQE1395KNB**	**CAP,P 3.95UF-K-100V**
C760	TACCV101T50V	CAP,C 100PF/50V
C801	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C802	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C803	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C804	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C805	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C806	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C807	ECA1HM2R2B	CAP,E 2.2UF-50V
C808	ECA1CM101B	CAP,E 100UF/16V
C809	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C810	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C811	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C812	**ECQU2A224MVA**	**CAP,P .22UF-M-250VAC**
C814	ECQB1H823JM3	CAP,P .082UF-J-50V
C815	ECA1HHG470B	CAP,E 47UF-50V
C818	ECKW3A821KBP	CAP,C 820PF-K-1KVDC
C820	**ECA1JHG100B**	**CAP,E 10UF-63V**
C821	ECKR2H561KB5	CAP,C 560PF-K-500V
C822	**ECA1EM221B**	**CAP,E 220UF-25V**
C823	**ECA160V33UE**	**CAP,E 33UF/160V**
C824	ECKW3A331KBP	CAP,C 330PF-K-1KV
C825	ECKW3A471KBP	CAP,C 470PF-K-1KV
C2201	ECA1HM4R7B	CAP,E 4.7UF-50V
C2202	ECA1HM2R2B	CAP,E 2.2UF-50V
C2203	ECA1HM4R7B	CAP,E 4.7UF-50V
C2204	AP106K016CAE	CAP,T 10UF/16V
C2205	ECA1HM010B	CAP,E 1UF-50V
C2206	ECQB1H223JM3	CAP,P .022UF-J-50V
C2207	AP335K016CAE	CAP,T 3.3UF/16V
C2208	TCJ2VB1C104K	CAP,C .1UF-K-16V
C2209	TCJ2VB1C104K	CAP,C .1UF-K-16V
C2210	TCJ2VB1C104K	CAP,C .1UF-K-16V
C2212	ECQB1H473JM3	CAP,P .047UF-J-50V
C2215	ECA0JM101B	CAP,E 100UF-6.3V
C2218	ECA1HMR47B	CAP,E .47UF-50V
C2220	EEANA1E100B	CAP,E 10UF-25V
C2301	ECA1VM102E	CAP,E 1000UF-35V
C2302	ECA1HM010B	CAP,E 1UF-50V
C2305	ECA1HM010B	CAP,E 1UF-50V
C2306	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C2307	ECA1CM102B	CAP,E 1000UF/16V
C2309	ECQB1H473JM3	CAP,P .047UF-J-50V
C2311	ECA1HM2R2B	CAP,E 2.2UF-50V

REF NO.	PART NO.	DESCRIPTION
C2313	ECA1EM101B	CAP,E 100UF-25V
C2314	ECQB1H473JM3	CAP,P .047UF-J-50V
C2315	ECA1EM100B	CAP,E 10UF-25V
C2321	ECA1EM100B	CAP,E 10UF-25V
C2324	ECA1EM100B	CAP,E 10UF-25V
C2325	ECA1CM102B	CAP,E 1000UF/16V
C2331	EEANA1E100B	CAP,E 10UF-25V
C2332	EEANA1E100B	CAP,E 10UF-25V
C2333	ECA1HM0R1B	CAP,E 0.1UF/50V
C2334	TCJ2VB1H472K	CAP,C 4700PF-K-50V
C2335	ECA1AM470B	CAP,E 47UF-10V
C2336	ECQB1H104JM3	CAP,P .1UF-J-50V
C2337	ECA1HM0R1B	CAP,E 0.1UF/50V
C2338	ECA1EM4R7B	CAP,E 4.7UF/25V
C2339	ECA1CM100B	CAP,E 10UF-16V
C2340	ECA1HMR47B	CAP,E .47UF-50V
C2341	ECA1EM4R7B	CAP,E 4.7UF/25V
C2342	ECA1EM4R7B	CAP,E 4.7UF/25V
C2343	ECA1EM4R7B	CAP,E 4.7UF/25V
C2344	TCJ2VB1H472K	CAP,C 4700PF-K-50V
C2345	ECA1HM0R1B	CAP,E 0.1UF/50V
C2346	ECA1AM470B	CAP,E 47UF-10V
C2347	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C2351	ECA1HM010B	CAP,E 1UF-50V
C2353	ECA1HM010B	CAP,E 1UF-50V
C2359	ECA1HM010B	CAP,E 1UF-50V
C2360	ECA1HM010B	CAP,E 1UF-50V
C2362	ECA1AM470B	CAP,E 47UF-10V
C3011	ECA1HM010B	CAP,E 1UF-50V
C3012	ECA1HM010B	CAP,E 1UF-50V
C3013	ECA1CM100B	CAP,E 10UF-16V
C3014	ECA1CM100B	CAP,E 10UF-16V
C3018	ECA1HM010B	CAP,E 1UF-50V
C3019	ECA1HM010B	CAP,E 1UF-50V
C3025	ECA1HM100B	CAP,E 10UF/50V
C3234	ECA1AM470B	CAP,E 47UF-10V
C3240	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6501	ECEA1CKA101B	CAP,E 100UF-16V
C6502	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6503	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6504	TCJ2VC1H270J	CAP,C 27PF-J-50V
C6507	TCJ2VC1H120J	CAP,C 12PF-J-50V
C6508	TCJ2VC1H390J	CAP,C 39PF-J-50V
C6509	TCJ2VC1H270J	CAP,C 27PF-J-50V
C6510	TCJ2VC1H120J	CAP,C 12PF-J-50V
C6511	ECEA1HKA010B	CAP,E 1.0UF-50V
C6512	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6513	TCJ2VC1H270J	CAP,C 27PF-J-50V
C6514	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6515	TCJ2VC1H101J	CAP,C 100PF-J-50V
C6516	TCJ2VF1H103Z	CAP,C .01UF-Z-50V

REPLACEMENT PARTS LIST

Model:CT-20SX11E/CE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C6517	ECEA1HN010UB	CAP,E 1UF/50V
C6518	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6520	ECEA1CKA100B	CAP,E 10UF-16V
C6521	ECEA1CKA470B	CAP,E 47UF-16V
C6522	TCJ2VC1H221J	CAP,C 220PF-J-50V
C6523	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C6524	ECEA1HKA010B	CAP,E 1.0UF-50V
C6525	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6526	ECEA1CKA100B	CAP,E 10UF-16V
C6527	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C6528	ECEA1CKA470B	CAP,E 47UF-16V
C6529	ECEA1CKA100B	CAP,E 10UF-16V
C6531	TCJ2VF1H103Z	CAP,C .01UF-Z-50V
C6532	TCUV1H103KBN	CAP,C .01UF-K-50V
		DIODES
D001	ERA15-01V3	DIODE, RECTIFIER
D002	MA165TA5VT	DIODE, SWITCHING
D003	MA4047HTA	DIODE
D006	MA4330HTA	DIODE
D008	MA165TA5VT	DIODE, SWITCHING
D009	MA165TA5VT	DIODE, SWITCHING
D011	MA165TA5VT	DIODE, SWITCHING
D014	MA165TA5VT	DIODE, SWITCHING
D015	MA165TA5VT	DIODE, SWITCHING
D016	MA165TA5VT	DIODE, SWITCHING
D017	MA165TA5VT	DIODE, SWITCHING
D026	MA4056MTA	DIODE
D451	ERA15-01V3	DIODE, RECTIFIER
D452	MA4047MTA	DIODE
D453	MA165TA5VT	DIODE, SWITCHING
D461	MA27WTA	DIODE
D501	MA4082LTA	DIODE
D531	**AS01V0**	**DIODE**
D532	**MA4062LTVTA**	**DIODE, ZENER**
D551	**TVSRU2NV1**	**DIODE, SILICONE**
D554	**BYD33G-163**	**DIODE**
D555	MA165TA5VT	DIODE, SWITCHING
D556	MA4360HTA	DIODE, ZENER
D557	**TVSRU2NV1**	**DIODE, SILICONE**
D558	**RS3FS**	**DIODE**
D559	**BYD33G-113**	**DIODE**
D560	MA165TA5VT	DIODE, SWITCHING
D561	**BYD33G-163**	**DIODE**
D751	MA2270B	DIODE
D801	**GP15KL-042**	**DIODE**
D802	**GP15KL-042**	**DIODE**
D806	MA4056MTA	DIODE
D807	MA165TA5VT	DIODE, SWITCHING
D809	**RU3YX-MV1**	**DIODE, RECTIFIER**
D810	**TAP2A102M005**	**DIODE (THERMISTOR)**
D820	EU02V1	DIODE

REF NO.	PART NO.	DESCRIPTION
D821	EU02V1	DIODE
D822	EU02V1	DIODE
D823	RL30A	DIODE
D824	EU02V1	DIODE
D825	**TVSSR2KLV1**	**DIODE, PROTECTION**
D826	EU02V1	DIODE
D829	MA165TA5VT	DIODE, SWITCHING
D830	**MA4270MTA**	**DIODE**
D2301	MA165TA5VT	DIODE, SWITCHING
D2305	MA4110MTA	DIODE, ZENER
D2306	MA4110MTA	DIODE, ZENER
D2307	MA4110MTA	DIODE, ZENER
D2308	MA4110MTA	DIODE, ZENER
D2315	MA165TA5VT	DIODE, SWITCHING
D2342	MA165TA5VT	DIODE, SWITCHING
D2343	MA165TA5VT	DIODE, SWITCHING
D3001	MA4110MTA	DIODE, ZENER
D3002	MA4110MTA	DIODE, ZENER
D3003	MA4110MTA	DIODE, ZENER
D3004	MA4110MTA	DIODE, ZENER
D3005	MA4110MTA	DIODE, ZENER
D3006	MA4110MTA	DIODE, ZENER
D3007	MA4110MTA	DIODE, ZENER
D3008	MA4110MTA	DIODE, ZENER
D3009	MA4110MTA	DIODE, ZENER
D3010	MA4110MTA	DIODE, ZENER
D3011	MA4110MTA	DIODE, ZENER
D3012	MA4110MTA	DIODE, ZENER
D3017	MA4110MTA	DIODE, ZENER
D3018	MA4110MTA	DIODE, ZENER
D3019	MA4110MTA	DIODE, ZENER
D3020	MA4110MTA	DIODE, ZENER
D3021	MA4110MTA	DIODE, ZENER
D3022	MA4110MTA	DIODE, ZENER
		FUSES
F801	**XBA2A00101**	**FUSE 6.3A 125V**
		INTEGRATED CIRCUITS
IC001	**MN1874088TL3**	**MPU**
IC002	C3EAEC000016	EEPROM
IC003	PIC-37042SR	REMOTE SENSOR
IC101	**AN5166K**	**VCJ**
IC451	**LA7837-TV**	**V OUT**
IC551	AN78M09LB	9 VOLT REG.
IC552	AN78M05LB	PLUS 5V AVR
IC801	**PC817X2**	**OPTHO COUPLER**
IC803	**STR58041A**	**POWER SUPPLY**
IC2201	AN5829S-E1V	MTS
IC2302	AN5272	AUDIO AMP
IC2321	CXA2021S	AUDIO CONTROL
IC3001	MM1114XFBE	VIDEO SW
IC6501	MN82840	COMB FILTER

REPLACEMENT PARTS LIST

Model:CT-20SX11E/CE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
IC6502	PST9142NR	RESET
	COILS	
JS08	EXCELSA35V	FERRITE BEAD
L001	EXCELSA35V	FERRITE BEAD
L002	ELESN2R2KA	COIL, PEAKING 2.2UH
L003	TLTABT2R2K	COIL, PEAKING 2.2UH
L004	TLTABT2R2K	COIL, PEAKING 2.2UH
L006	EXCELSA24T	FERRITE BEAD
L008	TLTABT470K	COIL, PEAKING 47UH
L103	ELESN150JA	COIL, PEAKING 15UH
L104	TLUABTA390K	COIL, PEAKING 39UH
L105	EIV7EN053B	COIL, VCO
L106	ELESN180JA	COIL, PEAKING 18UH
L451	EXCELDR35V	FERRITE BEAD
L551	**ELH5L4101**	**COIL**
L554	EXCELSA24T	FERRITE BEAD
L555	EXCELSA24T	FERRITE BEAD
L556	EXCELSA24T	FERRITE BEAD
L751	**ELC18B501E**	**COIL**
L752	EXCELDR35V	FERRITE BEAD
L801	**ELF15N013A**	**LINE FILTER**
L804	EXCELSA39V	FERRITE BEAD
L805	EXCELSA39V	FERRITE BEAD
L2302	TLTABT2R2K	COIL, PEAKING 2.2UH
L2303	EXCELDR25V	FERRITE BEAD
L2304	EXCELDR25V	FERRITE BEAD
L2305	EXCELDR35V	FERRITE BEAD
L6502	ELESN150JA	COIL, PEAKING 15UH
L6504	ELESN330JA	COIL, PEAKING 33UH
L6505	ELESN330JA	COIL, PEAKING 33UH
L6507	EXCELDR25V	FERRITE BEAD
L6509	EXCELSA35V	FERRITE BEAD
	TRANSISTORS	
Q001	2SD601ARTX	TRANSISTOR
Q002	2SC1685QRSTA	TRANSISTOR
Q003	2SB709ARTX	TRANSISTOR
Q004	2SB709ARTX	TRANSISTOR
Q302	2SD601ARTX	TRANSISTOR
Q303	2SB709ARTX	TRANSISTOR
Q304	2SD601ARTX	TRANSISTOR
Q351	2SC3063RL	TRANSISTOR
Q352	2SC3063RL	TRANSISTOR
Q353	2SC3063RL	TRANSISTOR
Q430	2SD601ARTX	TRANSISTOR
Q451	2SD601ARTX	TRANSISTOR
Q452	2SD601ARTX	TRANSISTOR
Q501	**2SC4212HLB**	**TRANSISTOR**
Q551	**2SD2499LBMA2**	**TRANSISTOR**
Q751	2SC1685QRSTA	TRANSISTOR
Q752	2SA564AQRSTA	TRANSISTOR
Q753	**2SD1266PLB**	**TRANSISTOR**

REF NO.	PART NO.	DESCRIPTION
Q801	2SC1685RSTA	TRANSISTOR
Q802	2SC1384RS	TRANSISTOR
Q2302	2SB709ARTX	TRANSISTOR
Q2303	2SD601ARTX	TRANSISTOR
Q2362	2SB709ARTX	TRANSISTOR
Q2363	2SD601ARTX	TRANSISTOR
Q2409	2SD601ARTX	TRANSISTOR
Q2410	2SD601ARTX	TRANSISTOR
Q6501	2SD601ARTX	TRANSISTOR
Q6502	2SD601ARTX	TRANSISTOR
Q6503	2SD601ARTX	TRANSISTOR
Q6504	2SD601ARTX	TRANSISTOR
Q6505	2SD601ARTX	TRANSISTOR
Q6506	2SD601ARTX	TRANSISTOR
Q6507	2SD601ARTX	TRANSISTOR
Q6509	2SD601ARTX	TRANSISTOR
Q6510	2SB709ARTX	TRANSISTOR
Q6516	2SB709ARTX	TRANSISTOR
Q6517	2SD601ARTX	TRANSISTOR
Q6519	2SD601ARTX	TRANSISTOR
	RELAYS	
RL801	**TSEH8007**	**RELAY**
	RESISTORS	
R002	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R003	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R004	ERDS1TJ181T	RES,C 180-J-1/2W
R005	ERDS2TJ101T	RES,C 100-J-1/4W
R006	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R007	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R008	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R009	ERJ6GEYJ221V	RES,M 220-J-1/10W
R010	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R011	ERJ6GEYJ474V	RES,M 470K-J-1/10W
R012	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R013	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R014	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R015	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R016	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R017	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R020	ERJ6GEYJ474V	RES,M 470K-J-1/10W
R021	ERJ6GEYJ101V	RES,M 100-J-1/10W
R022	ERJ6GEYJ101V	RES,M 100-J-1/10W
R023	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R024	ERJ6GEYJ221V	RES,M 220-J-1/10W
R025	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R027	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R030	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R031	ERJ6GEYJ471V	RES,M 470-J-1/10W
R032	ERJ6ENF1002V	RES,M 10K-F-1/10W
R033	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R034	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W

REPLACEMENT PARTS LIST

Model:CT-20SX11E/CE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R035	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R036	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R037	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R038	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R039	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R040	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R043	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R044	ERJ6GEYJ471V	RES,M 470-J-1/10W
R046	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R048	ERJ6GEYJ221V	RES,M 220-J-1/10W
R049	ERJ6GEYJ221V	RES,M 220-J-1/10W
R052	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R055	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R057	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R060	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R065	ERJ6GEYJ471V	RES,M 470-J-1/10W
R066	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R067	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R068	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R101	ERJ6GEYJ750V	RES,M 75-J-1/10W
R102	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R103	ERJ6GEYJ183V	RES,M 18K-J-1/10W
R104	ERJ6GEYJ561V	RES,M 560-J-1/10W
R105	ERJ6GEYJ561V	RES,M 560-J-1/10W
R107	ERJ6GEYJ471V	RES,M 470-J-1/10W
R108	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R152	ERJ6GEYJ183V	RES,M 18K-J-1/10W
R153	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R154	ERJ6GEYJ393V	RES,M 39K-J-1/10W
R201	ERJ6GEYJ471V	RES,M 470-J-1/10W
R202	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R203	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R303	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R304	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R305	ERJ6ENF3001V	RES,M 3K-F-1/10W
R306	ERJ6ENF1651V	RES,M 1.65K-F-1/10W
R307	ERJ6GEYJ394V	RES,M 390K-J-1/10W
R308	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R309	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R310	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R311	ERJ6GEYJ185V	RES,M 1.8MEG-J-1/10W
R313	ERJ6GEYJ471V	RES,M 470-J-1/10W
R314	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R317	ERJ6GEYJ684V	RES,M 680K-J-1/10W
R320	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R353	ERG2FJ123H	RES,M 12K-J-2W
R354	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R355	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R356	ERDS1TJ272T	RES,C 2.7K-J-1/2W

REF NO.	PART NO.	DESCRIPTION
R357	ERDS2TJ331T	RES,C 330-J-1/4W
R358	ERDS2TJ331T	RES,C 330-J-1/4W
R359	ERDS2TJ331T	RES,C 330-J-1/4W
R360	ERDS2TJ122T	RES,C 1.2K-J-1/4W
R361	ERDS2TJ122T	RES,C 1.2K-J-1/4W
R362	ERDS2TJ122T	RES,C 1.2K-J-1/4W
R363	ERDS2TJ101T	RES,C 100-J-1/4W
R364	ERDS2TJ101T	RES,C 100-J-1/4W
R365	ERDS2TJ101T	RES,C 100-J-1/4W
R401	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R430	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R432	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R451	ERDS1FJ1R2P	RES,C 1.2-J-1/2W
R454	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R455	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R456	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R457	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R458	ERJ6GEYJ273V	RES,M 27K-J-1/10W
R459	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R460	ERDS2TJ102T	RES,C 1K-J-1/4W
R462	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R463	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R465	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R466	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R467	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R468	ERJ6GEYJ101V	RES,M 100-J-1/10W
R469	ERJ6GEYJ220V	RES,M 22-J-1/10W
R471	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R501	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R502	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R503	ERJ6GEYJ822V	RES,M 8.2K-J-1/10W
R504	ERJ6GEYJ561V	RES,M 560-J-1/10W
R505	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R506	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R507	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R508	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R509	ERDS2TJ331T	RES,C 330-J-1/4W
R510	**ERG3FJ202H**	**RES,M 2K-J-3W**
R512	ERG2FJ562H	RES,M 5.6K-J-2W
R531	**ERD25FJ470P**	**RES,C 47-J-1/4W**
R532	**ERJ6ENF1102V**	**RES,M 11K-F-1/10W**
R533	**ERJ6ENF3901V**	**RES,M 3.9K-F-1/10W**
R536	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R537	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R538	**ERJ6GEYJ223V**	**RES,M 22K-J-1/10W**
R550	**ERDS1FJ1R0P**	**RES,C 1.0-J-1/2W**
R551	**ERDS1FJ1R0P**	**RES,C 1.0-J-1/2W**
R552	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R556	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R557	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R558	**ERQ2CJP4R7S**	**RES,F 4.7-J-2W**

REPLACEMENT PARTS LIST

Model:CT-20SX11E/CE

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REF NO.	PART NO.	DESCRIPTION
R559	ERG2FJ683H	RES,M 12K-J-2W
R560	ERDS1FJ182P	RES,C 1.8K-J-1/2W
R563	ERDS2TJ124T	RES,C 120K-J-1/4W
R564	ERDS2TJ104T	RES,C 100K-J-1/4W
R565	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R566	**ERX12SJR22P**	**RES,M .22-J-1/2W**
R567	ERG2FJ122H	RES,M 12K-J-2W
R573	ERG3FJ220H	RES,M 22-J-3W
R602	ERJ6GEYJ331V	RES,M 330-J-1/10W
R603	ERJ6GEYJ331V	RES,M 330-J-1/10W
R604	ERJ6GEYJ331V	RES,M 330-J-1/10W
R614	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R752	ERDS2TJ333T	RES,C 33K-J-1/4W
R753	ERDS2TJ103T	RES,C 10K-J-1/4W
R754	ERG3FJ562	RES,M 5.6K-J-3W
R755	ERDS2TJ563T	RES,C 56K-J-1/4W
R756	ERDS2TJ103T	RES,C 10K-J-1/4W
R757	ERDS2TJ224T	RES,C 220K-J-1/4W
R758	ERDS2TJ273T	RES,C 27K-J-1/4W
R759	ERDS2TJ222T	RES,C 2.2K-J-1/4W
R760	EVND8AA03B53	CONTROL 5K
R761	EVND8AA03B14	CONTROL 10K
R762	ERDS2TJ182T	RES,C 1.8K-J-1/4W
R763	ERDS2TJ183T	RES,C 18K-J-1/4W
R764	ERDS2TJ154T	RES,C 150K-J-1/4W
R765	ERDS2TJ272T	RES,C 2.7K-J-1/4W
R766	ERDS2TJ362T	RES,C 3.6K-J-1/4W
R767	ERDS2TJ222T	RES,C 2.2K-J-1/4W
R768	**ERQ2CJP100S**	**RES,F 10-J-2W**
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R804	ERW12PK1R8C	RES,W 1.8-K-1/2W
R805	ERDS2TJ274T	RES,C 27K-J-1/4W
R806	ERDS2TJ274T	RES,C 27K-J-1/4W
R808	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R809	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R810	ERDS1FJ272T	RES,C 2.7K-J-1/2W
R812	ERDS1TJ183T	RES,C 18K-J-1/2W
R813	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R815	**ERC12ZGM825D**	**RES,S 8.2MEG-M-1/2**
R818	**ERQ12HJR56P**	**RES,F .56-J-1/2W**
R820	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R821	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R822	ERD50FJ474P	RES,C 470K-J-1/2W
R823	ERDS2TJ222T	RES,C 2.2K-J-1/4W
R824	ERG3FJ680H	RES,M 68-J-3W
R825	ERDS2TJ102T	RES,C 1K-J-1/4W
R826	**ERF2AKR33P**	**RES,W .33-K-2W**
R827	ERDS1FJ561P	RES,C 560-J-1/2W
R828	ERG3FJ470	RES,M 47-J-3W
R829	ERQ14AJ270P	RES,F 27-J-1/4W
R2201	ERJ6GEYJ224V	RES,M 220K-J-1/10W

REF NO.	PART NO.	DESCRIPTION
R2206	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R2207	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R2220	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2301	ERQ2CJP1R0S	RES,F 1.0-J-2W
R2305	ERD25FJ180T	RES,C 18-J-1/4
R2306	ERD25FJ180T	RES,C 18-J-1/4
R2307	ERJ6GEYJ221V	RES,M 220-J-1/10W
R2308	ERJ6GEYJ221V	RES,M 220-J-1/10W
R2311	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R2312	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2318	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R2319	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R2321	ERDS2TJ181T	RES,C 180-J-1/4W
R2322	ERDS2TJ181T	RES,C 180-J-1/4W
R2323	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R2325	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R2329	ERJ6GEYJ681V	RES,M 680-J-1/10W
R2330	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2332	ERJ6GEYJ681V	RES,M 680-J-1/10W
R2333	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2334	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R2336	ERJ6GEYJ105V	RES,M 1M-J-1/10W
R2337	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2338	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2339	ERJ6GEYJ334V	RES,M 330K-J-1/10W
R2352	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2357	ERJ6GEYJ221V	RES,M 220-J-1/10W
R2359	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2361	ERJ6GEYJ221V	RES,M 220-J-1/10W
R2362	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2363	ERJ6GEYJ471V	RES,M 470-J-1/10W
R2364	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R2366	ERDS2TJ222T	RES,C 2.2K-J-1/4W
R2367	ERDS2TJ222T	RES,C 2.2K-J-1/4W
R2418	ERJ6GEYJ471V	RES,M 470-J-1/10W
R2419	ERJ6GEYJ471V	RES,M 470-J-1/10W
R3012	ERDS2TJ331T	RES,C 330-J-1/4W
R3013	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R3014	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R3016	ERJ6GEYJ750V	RES,M 75-J-1/10W
R3017	ERJ6GEYJ750V	RES,M 75-J-1/10W
R3021	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R3026	ERDS2TJ331T	RES,C 330-J-1/4W
R3028	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R3033	ERJ6GEYJ101V	RES,M 100-J-1/10W
R3034	ERJ6GEYJ101V	RES,M 100-J-1/10W
R3041	ERDS2TJ102T	RES,C 1K-J-1/4W
R3042	ERDS2TJ102T	RES,C 1K-J-1/4W
R3216	ERJ6GEYJ750V	RES,M 75-J-1/10W
R6501	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R6502	ERJ6GEYJ471V	RES,M 470-J-1/10W

REPLACEMENT PARTS LIST

Model:CT-20SX11E/CE

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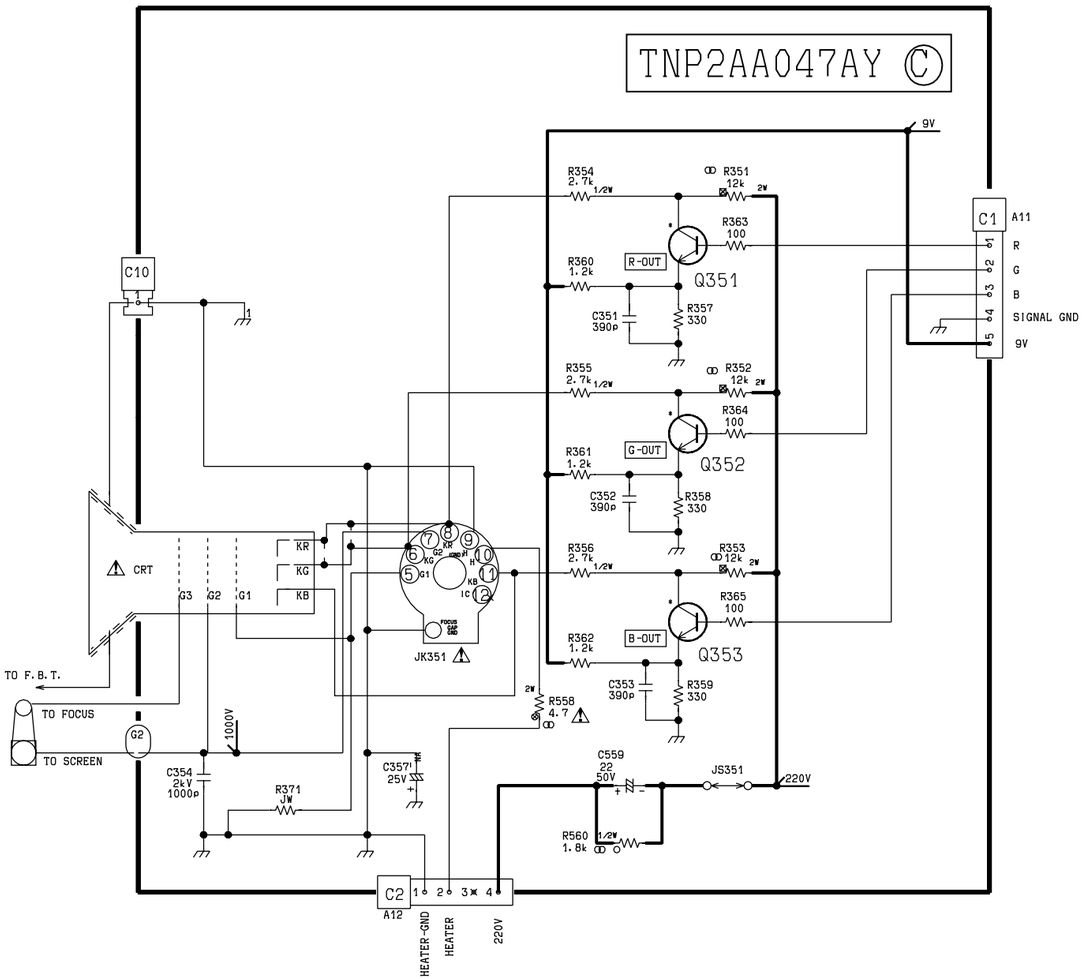
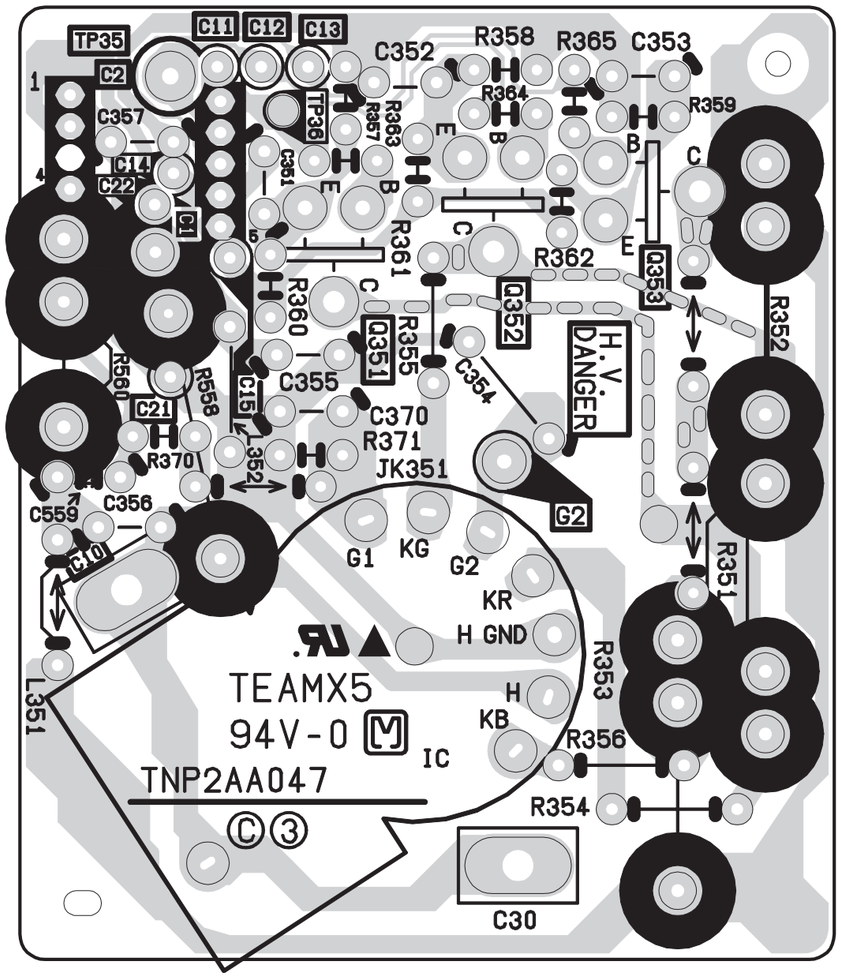
REF NO.	PART NO.	DESCRIPTION
R6503	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R6504	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R6505	ERJ6GEYJ471V	RES,M 470-J-1/10W
R6506	ERJ6GEYJ471V	RES,M 470-J-1/10W
R6507	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6508	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6509	ERJ6GEYJ471V	RES,M 470-J-1/10W
R6510	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6511	ERJ6GEYJ123V	RES,M 12K-J-1/10W
R6512	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6513	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R6515	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6516	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R6517	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R6518	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R6519	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R6520	ERJ6GEYJ751V	RES,M 750-J-1/10W
R6521	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6522	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6523	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R6524	ERJ6GEYJ471V	RES,M 470-J-1/10W
R6526	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6529	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R6530	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R6535	ERJ6GEYJ181V	RES,M 180-J-1/10W
R6537	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R6538	ERJ6GEYJ122V	RES,M 1.2K-J-1/10W
R6540	ERJ6GEYJ151V	RES,M 150-J-1/10W
R6542	ERJ6GEYJ680V	RES,M 68-J-1/10W
R6543	ERJ6GEYJ122V	RES,M 1.2K-J-1/10W
R6545	ERJ6GEYJ221V	RES,M 220-J-1/10W
R6549	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R6552	ERJ6GEYJ101V	RES,M 100-J-1/10W
R6553	ERJ6GEYJ101V	RES,M 100-J-1/10W
R6554	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R6555	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R6556	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R6557	ERJ6GEYJ123V	RES,M 12K-J-1/10W
R6558	ERJ6GEYJ331V	RES,M 330-J-1/10W
R6559	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R6560	ERJ6GEYJ124V	RES,M 120K-J-1/10W
R6565	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R6566	ERJ6GEYJ681V	RES,M 680-J-1/10W
R6567	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R6568	ERJ6GEYJ471V	RES,M 470-J-1/10W
R6571	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
		SWITCHES
S001	TSE2AD001	SWITCH, PUSH
S002	TSE2AD001	SWITCH, PUSH
S003	TSE2AD001	SWITCH, PUSH
S004	TSE2AD001	SWITCH, PUSH
S005	TSE2AD001	SWITCH, PUSH
S008	TSE2AD001	SWITCH, PUSH
S009	TSE2AD001	SWITCH, PUSH
		TRANSFORMERS
T001	**TLP16297**	**TRANSFORMER, POWER SUPPLY**
T501	**ETH09K8CZ**	**TRANSFORMER**
T502	**ETE19Z30DY**	**TRANSFORMER**
T551	**KFT3AB119F1**	**FLYBACK TRANSFORMER**
T751	**ETE19Z30EY**	**TRANSFORMER**
T801	**ETS29AK3K5NC**	**TRANSFORMER, CHOPPER**
		CRISTALS/FILTERS
X001	TSSA010	CRYSTAL
X101	M1972M	FILTER
X102	EFCS4R5MW5BA	FILTER, BANDPASS
X201	SFSH4R5MDB	CRYSTAL
X501	TAFCSB503F38	CRYSTAL, CLOCK
X601	TSS2AA001	CRYSTAL, 3.58MHZ
		OTHERS
TNR001	**ENV56D51G3**	**TUNER**
M001	**TSX2AA0111-1**	**A/C LINE CORD**
M002	**A51LSK955X-A**	**CRT 20**
M003	**TJSC00300**	**CRT SOCKET**
DY	**TLY2AA019**	**DEFLECTION YOKE**
M004	TXF3A011DB2	ASSY. DAG GROUND
DEG	**TSP2AA018**	**COIL, DEGAUSSING**
M005	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
M006	JH291U-009	YOKE, CONVERGENCE
M007	TAS2AA0023	SPEAKER 8-OHM
M008	TBM2A30843	BADGE, PANASONIC
M009	TBX2AA0171G	BUTTON, 7-KEY
M010	TEK6940	DOOR CATCH
M011	TXFKY38ESER	ASSY, CABINET FRONT
M012	TXFKU29ESER	ASSY, CABINET BACK
M013	TKP2AA0613S	ASSY, CONTROL DOOR
M014	TKX2AA0132	GUIDE, IR
M015	TXFEA0041DBS	SPEAKER BRACKETS
JK3001	TJB2AA0181	TERMINAL, A/V
JK3002	TJB2AA0045	TERMINAL, FRONT A/V
JK3003	TJB2AA0171	TERMINAL, S-VHS
		ACCESORIES
M016	EUR511502	REMOTE CONTROL
M017	UR51EC975A	BATTERY COVER, REMOTE CON
M018	TQB2AA0407	MANUALS, OWNERS *CT-20SX11E*
M019	TQB2AA0408	MANUAL, OWNERS *CT-20SX11CE*
M020	TQB2AA7058	REMOTE GUIDE
M021	TQB2AA7075	V-CHIP CANADIAN





	Q351
B	3.23
C	136.29
E	3.00

	Q352
B	3.30
C	133.16
E	3.00

	Q353
B	3.34
C	132.8
E	3.00

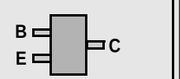
Nota:

La medición de los voltajes se hizo con un Voltímetro Digital.

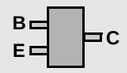
Note:

Obtained voltages with a multimeter.

CHIP TRANSISTOR LEAD DESIGNATION



IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in µH.
4. Test point indicated by ● Test point but no pin ⚲.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏚ indicates COLD GROUND.

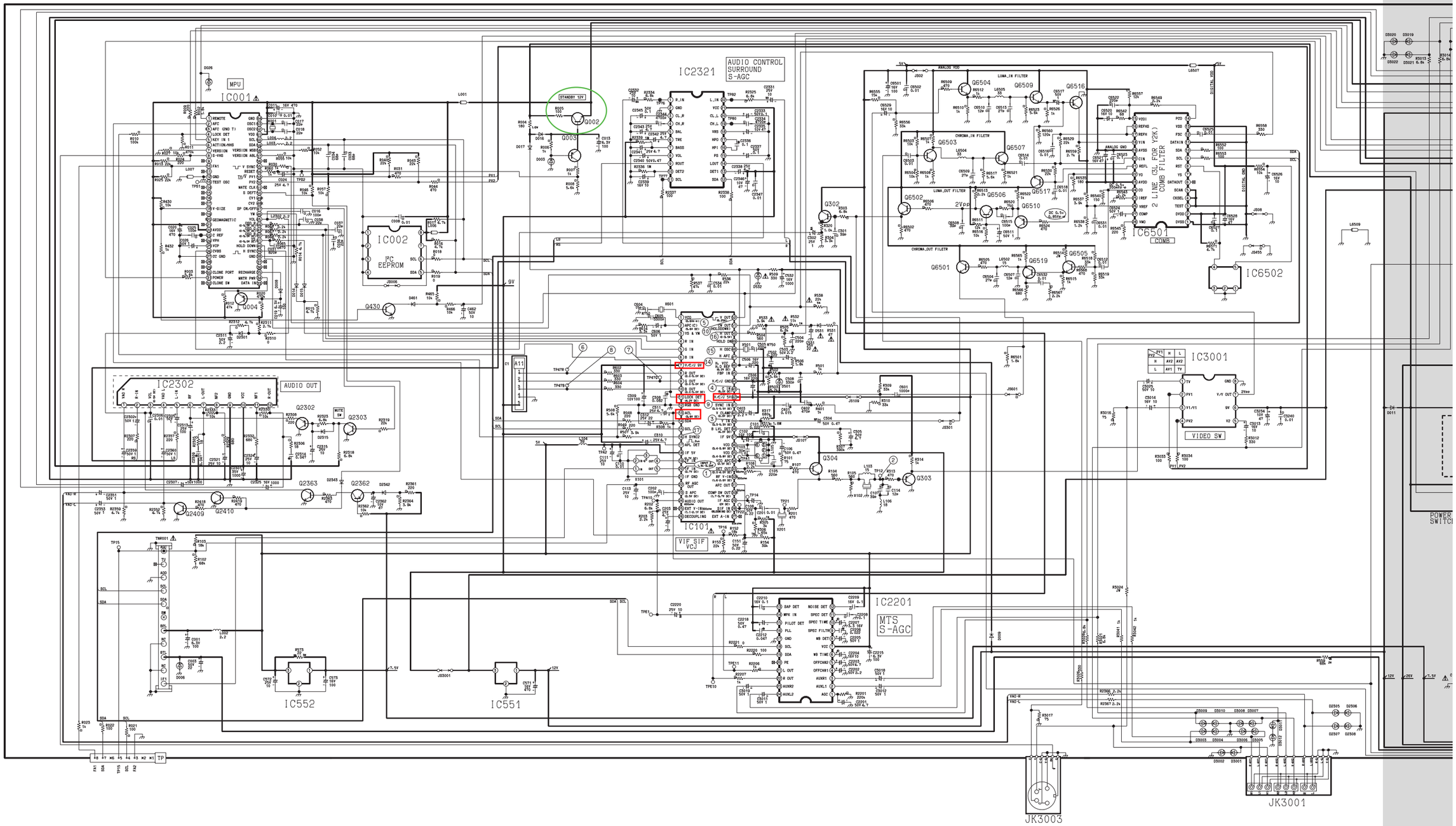
NOTE: All other component symbols are used for engineering design purposes.

Notas de los Diagramas

1. Las Resistencias son de Carbón de 1/4W, a menos que se indique otra característica.
2. Los Capacitores son de Cerámica para 50V, a menos que se indique otra característica.
3. El valor indicado de las Bobinas es la inductancia expresada en µH.
4. Los puntos de prueba en la terminal de algún componente son indicados por ● Los puntos de prueba fuera de los componentes se indican con ⚲.
5. Los componentes señalados con el símbolo ⚠ son considerados componentes críticos y deben ser reemplazados sólo con las partes especificadas por el fabricante.
6. ▬▬ (**LINEA GRUESA**) indica las líneas de alimentación de los Voltajes B+.
7. Los diagramas eléctricos están sujetos a cambio sin previo aviso.
8. El símbolo ⏚ indica que es una conexión a **Tierra Caliente** y el símbolo ⏚ indica conexión a **Tierra Fría**.

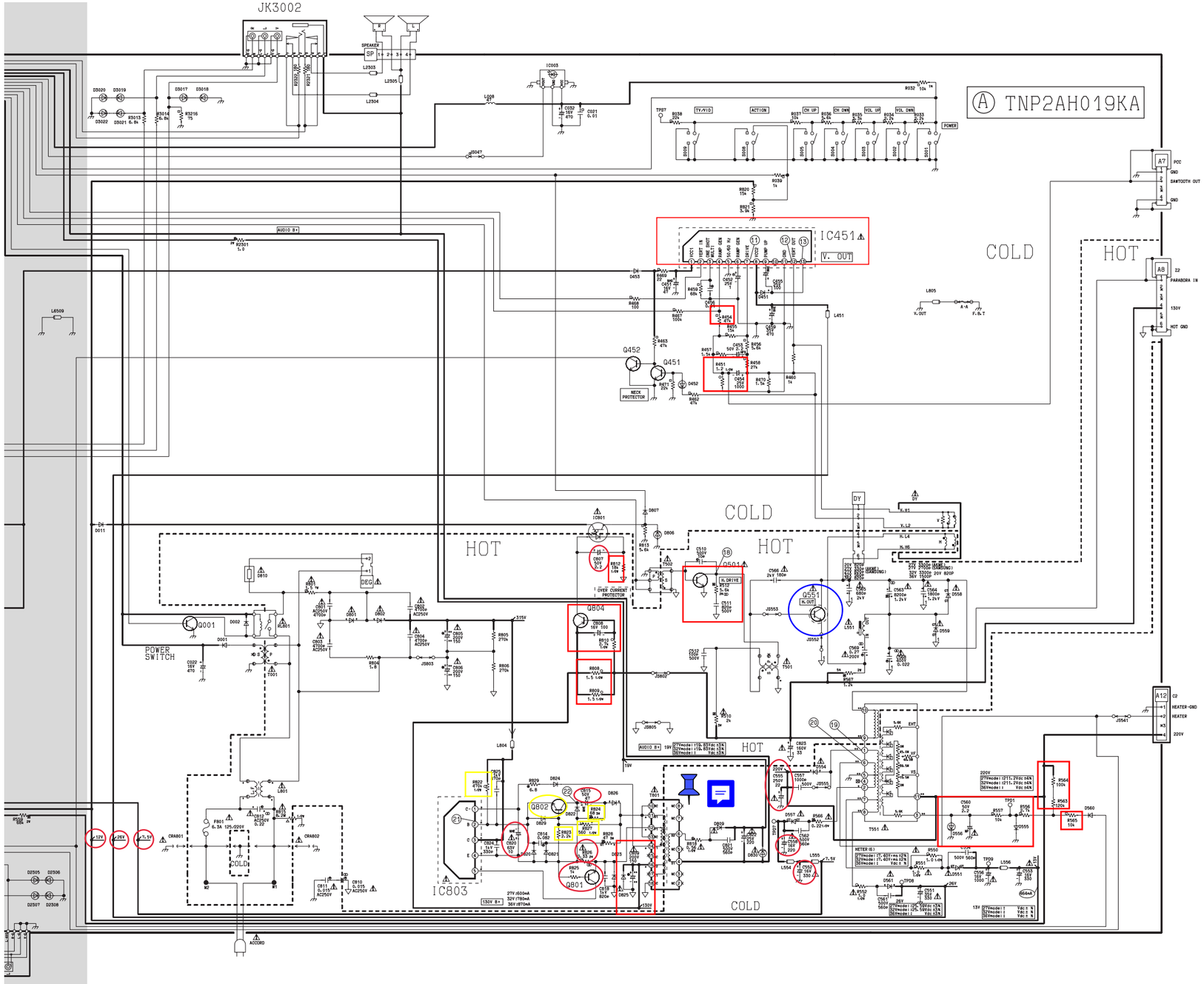
NOTA: Los demas símbolos de componentes incluidos son usados con fines de diseño.

A-BOARD SCHEMATIC LEFT PORTION -- DIAGRAMA ELECTRICO DE LA TARJETA A, SECCION IZQUIERDA



A-BOARD SCHEMATIC RIGHT PORTION -- DIAGRAMA ELECTRICO TARJETA A SECCION DERECHA

ALL MODELS



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NOTA DE SEGURIDAD

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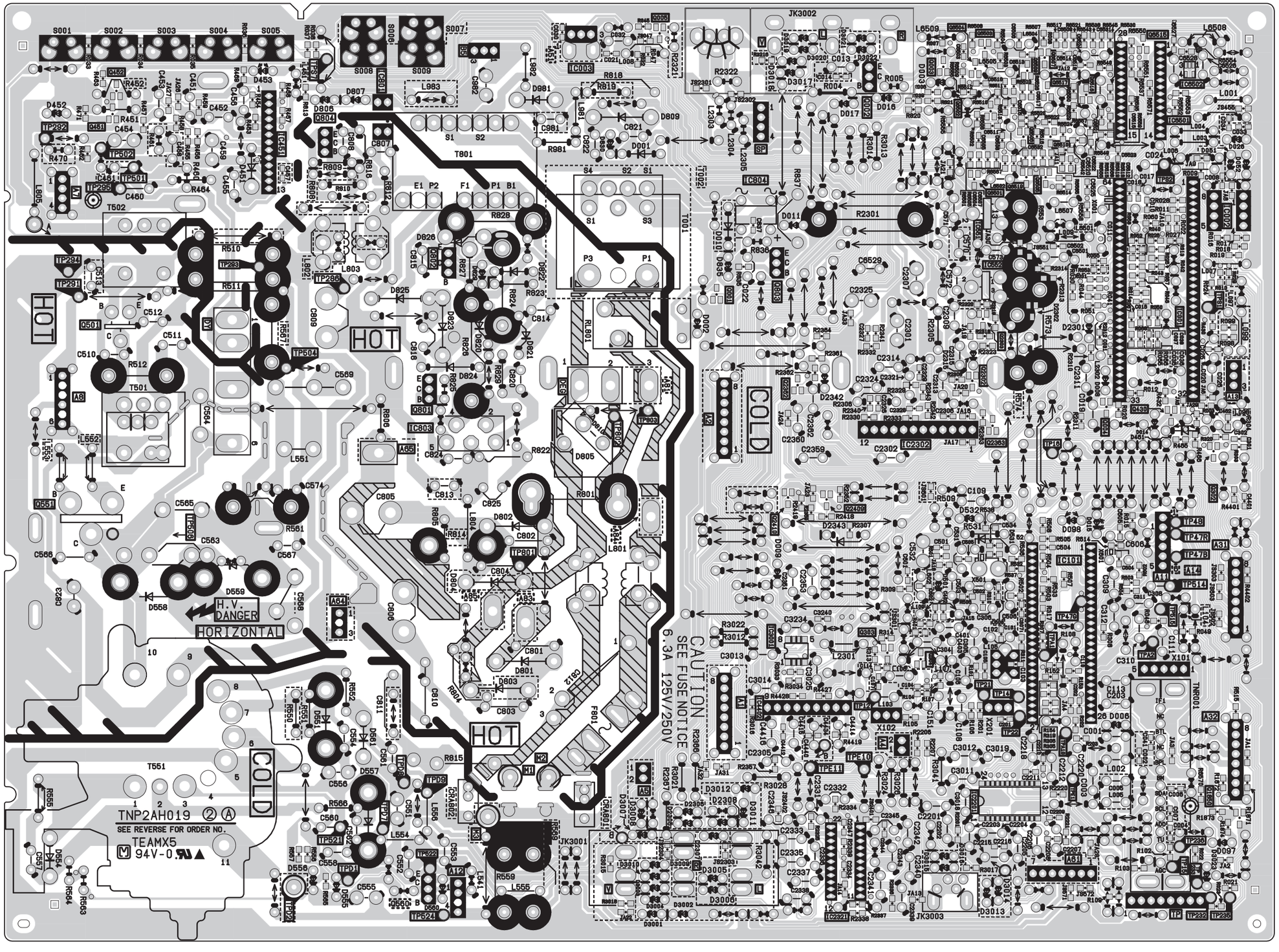

HOT
COLD
HOT
COLD
HOT
H.V.
DANGER
HORIZONTAL
CAUTION
SEE FUSE NOTICE
6.3A 125V/250V
TNP2AH019 ②Ⓐ
SEE REVERSE FOR ORDER NO.
TEAMX5
94V-0
JK3002
JK3001
JK3003

IC001			
1	4.40	33	0.00
2	2.53	34	5.16
3	0.00	35	5.18
4	3.43	36	0.00
5	5.17	37	0.00
6	2.73	38	0.00
7	0.00	39	0.15
8	5.17	40	4.15
9	0.00	41	0.00
10	5.17	42	0.00
11	0.00	43	0.00
12	0.0	44	0.00
13	2.59	45	0.26
14	0.00	46	0.00
15	0.00	47	0.00
16	0.00	48	0.00
17	0.00	49	0.00
18	0.42	50	0.00
19	0.00	51	0.00
20	0.00	52	0.00
21	0.00	53	0.00
22	5.18	54	5.10
23	0.00	55	4.10
24	1.92	56	0.00
25	1.28	57	0.00
26	1.86	58	5.17
27	0.00	59	3.12
28	0.00	60	3.18
29	0.00	61	5.18
30	0.00	62	2.34
31	5.13	63	2.18
32	0.00	64	0.00

IC002	
1	0.00
2	0.00
3	0.00
4	0.00
5	3.14
6	3.16
7	0.00
8	5.18

IC003	
1	4.43
2	0.00
3	5.18

IC2321	
1	4.44
2	0.00
3	4.47
4	4.46
5	4.48
6	4.43
7	4.53
8	5.54
9	4.44
10	1.52
11	3.15
12	3.13
13	5.57
14	4.46
15	4.44
16	4.43
17	4.46
18	4.44
19	4.46
20	4.47
21	8.95
22	4.44

IC2201	
1	1.20
2	2.18
3	2.18
4	2.30
5	2.18
6	0.28
7	4.94
8	2.33
9	2.43
10	0.40
11	2.24
12	3.11
13	3.34
14	2.18
15	3.38
16	3.47
17	0.00
18	3.16
19	3.12
20	0.00
21	2.24
22	2.22
23	2.18
24	2.18

IC2302	
1	6.04
2	6.77
3	0.31
4	5.97
5	6.78
6	18.60
7	11.18
8	11.32
9	0.00
10	24.33
11	11.37
12	11.20

IC101			
1	2.80	27	4.93
2	5.64	28	3.17
3	0.00	29	2.61
4	0.00	30	2.22
5	0.00	31	4.66
6	0.00	32	1.77
7	8.95	33	2.98
8	3.24	34	2.60
9	3.29	35	3.42
10	3.28	36	3.42
11	4.20	37	8.96
12	0.00	38	3.99
13	3.36	39	4.37
14	3.14	40	2.82
15	3.18	41	4.44
16	0.00	42	4.49
17	3.50	43	3.58
18	4.91	44	0.00
19	2..71	45	0.47
20	2.71	46	6.03
21	0.00	47	4.01
22	1.62	48	2.09
23	5.10	49	5.30
24	4.09	50	0.86
25	17.81	51	6.01
26	5.75	52	4.11

IC3001	
1	4.04
2	0.00
3	4.05
4	0.00
5	4.05
6	8.96
7	4.28
8	0.00

IC551	
1	13.14
2	0.00
3	8.97

IC804	
1	13.50
2	0.00
3	6.40
4	6.27

IC451	
1	8.22
2	4.11
3	4.12
4	4.16
5	0.00
6	3.93
7	3.99
8	24.64
9	1.51
10	1.37
11	0.00
12	12.79
13	24.81

IC552	
1	8.44
2	0.00
3	4.96

IC6501	
1	0.00
2	4.96
3	0.00
4	0.00
5	0.00
6	0.00
7	0.00
8	4.95
9	3.18
10	3.15
11	0.00
12	2.41
13	0.00
14	2.32
15	2.47
16	3.46
17	3.46
18	2.35
19	0.00
20	2.46
21	1.47
22	0.50
23	4.95
24	0.38
25	1.14
26	1.13
27	3.58
28	0.57

IC6502	
1	0.00
2	0.00
3	0.00
4	4.95
5	4.93

IC801	
1	0.59
2	0.00
3	12.27
4	0.00

IC803	
1	90.12
2	132.14
3	249.21
4	131.90
5	133.2

	Q001	Q002	Q003	Q004	Q2302
B	0.75	5.86	5.01	4.89	24.30
C	0.00	10.14	5.83	0.00	0.00
E	0.00	5.18	5.83	5.16	18.60

	Q2303	Q2362	Q2363	Q2409	Q2410
B	0.00	8.45	0.00	0.00	0.00
C	24.32	0.00	0.30	0.00	0.00
E	0.00	7.90	0.00	0.00	0.00

	Q302	Q303	Q304	Q430	Q451
B	2.55	1.20	2.42	0.28	0.62
C	4.95	0.00	8.96	4.02	0.00
E	1.95	1.88	1.85	0.00	0.00

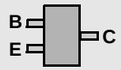
	Q452	Q501	Q551	Q6501	Q6502
B	0.00	0.00	0.00	3.30	3.23
C	3.60	82.70	17.00	4.96	4.96
E	0.00	0.00	0.00	2.68	2.57

	Q6503	Q6504	Q6505	Q6506	Q6507
B	2.40	3.30	2.38	2.25	2.71
C	2.71	5.00	4.96	3.24	4.95
E	1.79	2.70	1.76	1.65	2.08

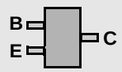
	Q6509	Q6510	Q6516	Q6517	Q6519
B	2.27	0.43	1.73	1.46	1.76
C	4.95	0.00	0.00	4.96	3.31
E	1.64	1.10	2.36	1.73	1.13

	Q801	Q802	Q803	Q804
B	132.10	129.40	12.00	131.90
C	133.00	133.00	13.60	0.59
E	132.20	133.10	12.30	132.30

IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



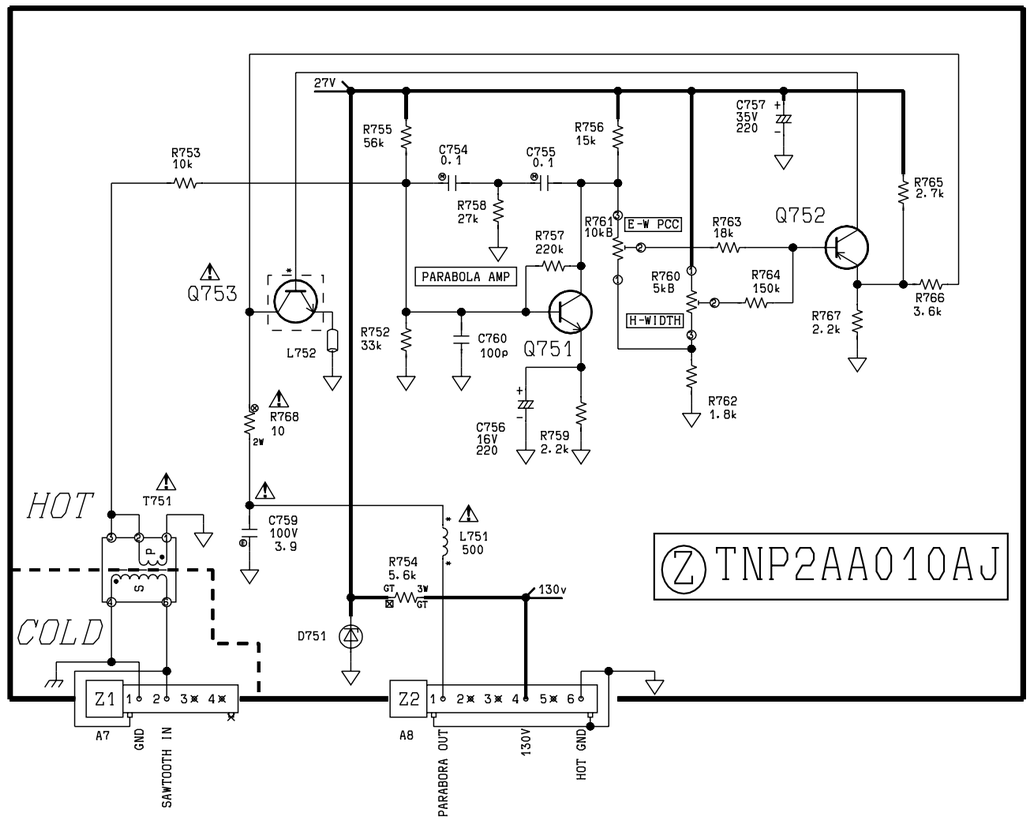
CHIP TRANSISTOR LEAD DESIGNATION

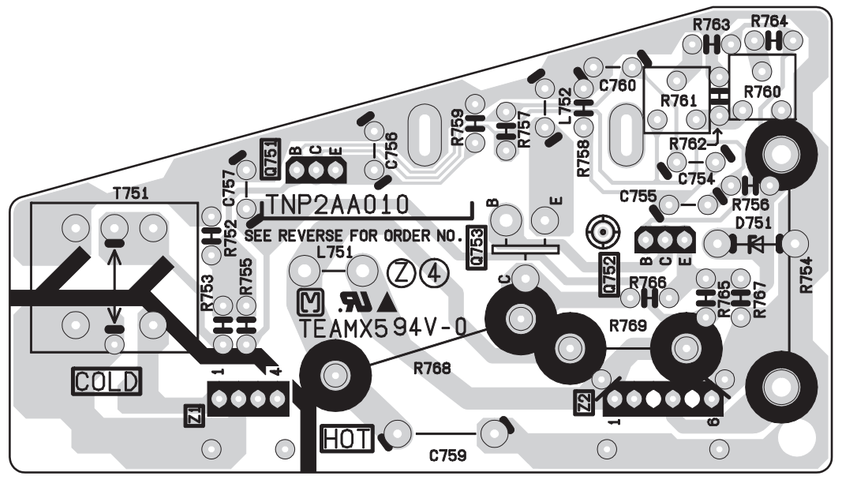


Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

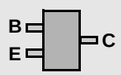
CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***



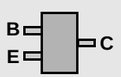


	Q751
B	0.00
C	11.52
E	0.00
	Q752
B	10.52
C	0.00
E	11.01
	Q753
B	0.60
C	8.06
E	0.00

IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



CHIP TRANSISTOR LEAD DESIGNATION



Nota:

La medición de los voltajes se hizo con un Voltímetro Digital.

Note:

Obtained voltages with a digital multimeter.

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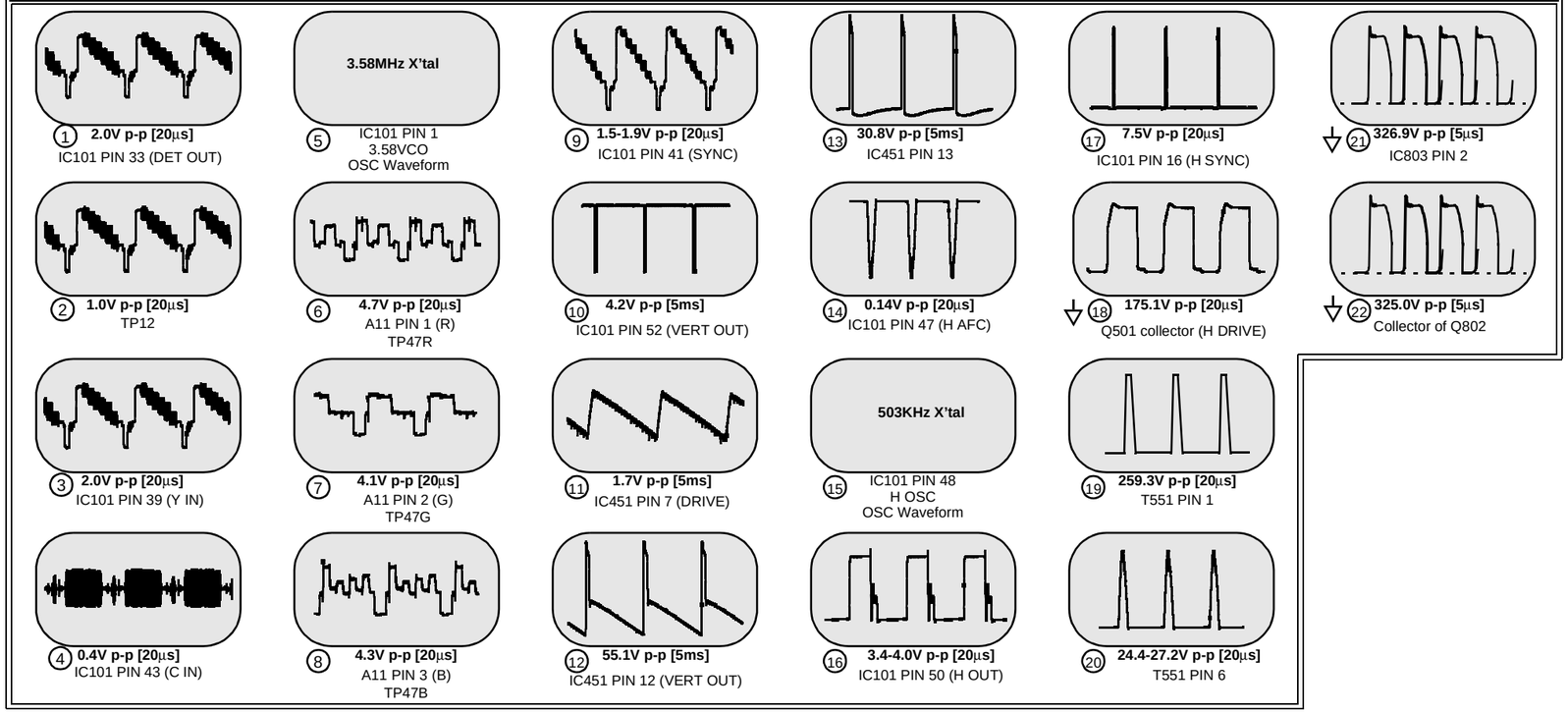
Waveforms - A-Board



1 **2.0V p-p [20µs]**
IC101 PIN 33 (DET OUT)

2 **1.0V p-p [20µs]**
TP12

3 **2.0V p-p [20µs]**
IC101 PIN 39 (Y IN)

4 **0.4V p-p [20µs]**
IC101 PIN 43 (C IN)

5 IC101 PIN 1
3.58VCO
OSC Waveform

6 **4.7V p-p [20µs]**
A11 PIN 1 (R)
TP47R

7 **4.1V p-p [20µs]**
A11 PIN 2 (G)
TP47G

8 **4.3V p-p [20µs]**
A11 PIN 3 (B)
TP47B

9 **1.5-1.9V p-p [20µs]**
IC101 PIN 41 (SYNC)

10 **4.2V p-p [5ms]**
IC101 PIN 52 (VERT OUT)

11 **1.7V p-p [5ms]**
IC451 PIN 7 (DRIVE)

12 **55.1V p-p [5ms]**
IC451 PIN 12 (VERT OUT)

13 **30.8V p-p [5ms]**
IC451 PIN 13

14 **0.14V p-p [20µs]**
IC101 PIN 47 (H AFC)

15 IC101 PIN 48
H OSC
OSC Waveform

16 **3.4-4.0V p-p [20µs]**
IC101 PIN 50 (H OUT)

17 **7.5V p-p [20µs]**
IC101 PIN 16 (H SYNC)

18 **175.1V p-p [20µs]**
Q501 collector (H DRIVE)

19 **259.3V p-p [20µs]**
T551 PIN 1

20 **24.4-27.2V p-p [20µs]**
T551 PIN 6

21 **326.9V p-p [5µs]**
IC803 PIN 2

22 **325.0V p-p [5µs]**
Collector of Q802

Medición de Formas de Onda

1. Un símbolo como 3 indica el punto para medir una señal. (La medición puede hacerse en el punto con mayor accesibilidad, siempre que sea común al indicado.)
2. Se midieron utilizando un generador con formato NTSC conectado a la terminal de la antena. (Patrón de 8 Barras de Colores EAI, formato NTSC de 100 IREs para el Blanco y 7.5 IREs para el Negro.)
3. Los ajustes de usuario de los Menus PICTURE y AUDIO se normalizaron. Posteriormente el nivel de volumen se ajusta al mínimo.
4. Las formas de onda de Video y Color fueron tomadas con un osciloscopio de banda alta y con un punta de prueba de baja capacitancia (10 a 1). La forma y amplitud de las ondas puede variar según el tipo de osciloscopio que se utilice y sus características.
5. El símbolo de tierra ⏚ que aparece junto al número de la forma de onda, indica que se utiliza conexión a **Tierra Caliente** en el extremo negativo de la punta de prueba.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

[redacted]

PARTS LIST ABBREVIATIONS GUIDE

RESISTOR			
TYPE		**TOLERANCE**	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

RES, C 270-J-1/4

CAPACITOR			
TYPE		**TOLERANCE**	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
		L	± 15%
		M	± 20%
		P	+10% -0%
		Z	+80% -20%

CAP, P .068UF-K-50V

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